APPENDICES

Appendix A1

Characteristics of Key Chemical Compounds of Concern During Mine Clearance Activities

APPENDIX A1

HERBICIDE CHEMICALS

Agent Orange and dioxin (IOM 1994)

- Agent Orange is a mixture of 2,4-D (2,4-Dichlorophenoxyacetic acid) and 2,4,5-T (2,4,5-Trichlorophenoxyacetic acid).
- Agent Orange was used as a general defoliant in Viet Nam between 1965 and 1970.
- 90% of all Agent Orange was sprayed on jungle, ~8% on food crops and ~2% was used by other branches of the military for special purposes (Gough 1986).
- 2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD) was found to be a contaminant present in the herbicide mixture.
- Given their low water solubility and resistance to rapid degradation, dioxins (particularly 2,3,7,8-tetrachlorodibenzo-*p*-dioxin [TCDD]) tend to partition into soil serving as a "reservoir" for the contaminant and effectively serves to facilitate the contamination of other media long after cessation of a contaminating activity and/or process has occurred (Webster and Commoner 1994).
- The ATSDR (1997) guideline for dioxin and dioxin-like compounds in residential soils has been set at 50 pg/g T-TEQ. The guideline states that in residential regions where soil T-TEQ levels exceed 50 pg/g, a further site-specific evaluation is required.
- The ATSDR (1997) indicates that if a soil dioxin level is <50 pg/g T-TEQ, a more detailed site-specific assessment may still be required based on overall community health concerns and a health assessor's concerns regarding other combinations of potential contaminants.

CHEMICALS FROM INCAPACITATING AGENTS

o-Chlorobenzylidene Malonotrilite (CS) (CDC 2001c)

- CS is a white crystalline solid, emitting a pepper-like odor.
- CS is combustible where fine droplets, powder or granules can form an explosive mixture in air.
- If inhaled, CS generates a burning sensation in the respiratory tract and throat, causes chest tightening, coughs, dizziness, headaches, labored breathing, nausea and vomiting.

- Skin contact with CS may result in redness, burning sensations, pain and, potentially, blistering.
- Eye exposure will result in redness, pain and tearing.
- Prevention of skin/eye contact and inhalation of CS is critical during handling (i.e., goggles and protective clothing are required).

2-Chloroacetophenone (CN) (CDC 2001d)

- CN is a colorless-to-gray crystalline substance with a sharp, irritating odor.
- CN decomposes on heating.
- Incineration of CN produces toxic and corrosive fumes.
- Inhalation is the principal mode of exposure.
- Short-term exposure will result in tearing, with irritation of the eyes, skin and respiratory tract.
- Inhalation exposure to CN may cause lung edema (i.e., the accumulation of fluid in the lungs).
- Direct skin and eye contact should be avoided.
- As with CS, appropriate clothing, goggles and general skin protection should be a regular protocol during handling.

CHEMICALS FROM UNEXPLODED ORDNANCE

2,4,6-Trinitrotoluene (TNT) (ATSDR 2001a)

- TNT is a yellow, colourless solid.
- TNT is used extensively in military shells, bombs and grenades.
- It moves in surface water and through soils to groundwater.
- TNT is rapidly broken down by sunlight in surface waters to other compounds.
- TNT is also broken down slowly by microorganisms in sediments and water.
- TNT has a capacity to bioaccumulate in small concentrations in fish and vegetable tissues.
- Primary exposure to TNT during UXO clearance would be through inhalation.
- Long-term exposure (365 days or longer) may result in anemia, abnormal liver function, spleen enlargement and cataract development.
- TNT is considered a possible carcinogen.

Cyclotetramethylene Tetranitrate (HMX) (ATSDR 2001b)

- HMX is a colorless solid that is slightly water soluble.
- Small amounts of HMX will evaporate.
- It can be adsorbed on to suspended particles or dust.
- HMX will explode violently at higher temperatures.
- HMX is used in various kinds of explosives, rocket fuels, and burster charges.
- HMX in surface waters will break down to other compounds in sunlight in a short period of time (i.e., days, weeks).
- HMX can move from soil to groundwater principally in sandy soils.
- The primary method of exposure to HMX would involve inhalation during UXO clearance.
- Laboratory studies indicates HMX may be harmful to liver tissue and the central nervous system.

1,3,5-Trinitro-1,3,5-Triazine (RDX) (ATSDR 2001c)

- RDX is a white highly explosive powder.
- RDX particles may enter the air during incineration.
- It dissolves and evaporates very slowly in water.
- RDX has a low affinity for soil particles thus having the capability to move into ground waters.
- RDK does not bioaccumulate in animal tissues.
- Inhalation and skin contact would be the primary mode of exposure during UXO clearance.
- RDX can cause seizure in humans when high concentrations are inhaled.
- Nausea and vomiting also result from extended exposure.
- RDX is a possible human carcinogen.

2,4,6-Trinitrophenyl-N-ethylnitramine (TETRYL) (CDC 2001a)

- TETRYL is odorless and colourless to yellow crystalline solid.
- It may decompose explosively on shock, friction, concussion or high temperature exposure.
- The principal mode of exposure to humans would be inhalation and absorption if skin contact is realized.

- Short term exposure may result in eye skin and respiratory irritations with the potential for effect on the nervous system.
- TETRYL may also cause insomnia, abdominal pains, diarrhea, headache, sore throat, nose bleeds and nausea.
- It emits toxic fumes during incineration and explosion.
- If working with TETRYL, protective clothing and eye protection is recommended.

Nitrobenzene (NB) (CDC 2001b)

- NB is a pale yellow, oily liquid.
- Exposure to NB would occur primarily through skin absorption or inhalation.
- Exposure could result in unconsciousness, blueing of skin and/or finger nails, dizziness, headache and nausea; protective gloves, clothing and eyewear are recommended.
- Combustion of NB gives off irritating/toxic fumes.
- If NB is in a dry state, this would result in a high explosive hazard.

1,3-Dinitrobenzene (DNB)/1,3,5-Trinitrobenzene (TNB) (ATSDR 2001d)

- High concentrations of DNB/TNB reduce the ability of blood to carry oxygen.
- DNB/TNB are in the form of yellow crystalline solids.
- These explosive crystals can be transported by air in low concentrations, adsorbed onto dust particles or in vapor; they break down slowly in air, water and soil.
- These explosives have a low affinity for soil; therefore, they may move through soil into groundwater.
- DNB/TNB are not bioaccumulative in animals.
- Inhalation and skin contact during UXO clearance would be the primary mode of exposure.

Pentaerythritol Tetranitrate (PETN) (University of Minnesota 2001)

- PETN is a highly explosive compound in the same family as nitroglycerin.
- PETN by itself has been used in detonators and detonating fuses.
- A mixture of PETN and TNT (called Pentolite) has been used in grenades and projectiles.
- PETN is a colorless crystalline material; it is easily detonated.
- PETN is the least stable of the military explosives in common uses; it may be stored for extended periods of time.
- PETN is a vasodilator, therefore it has been used at a heart stimulant.

- Bacteria are capable of some degradation.

White Phosphorous (WP) (ATSDR 2001e)

- WP is a waxy solid (colourless, white or yellow) with a garlic-like odor, which is extremely flammable.
- WP is used in various types of ammunitions and smoke munitions.
- Exposure to WP may result in burns, skin irritation, liver, kidney, heart, lung or bone damage.
- WP in air will react rapidly with oxygen, igniting at 10 to 15º above room temperature.
- WP in water reacts with oxygen within hours or days; however, in low oxygen waters, WP degrades to a highly toxic compound (phosphine) which evaporates.
- WP can bioaccumulate in fish.
- WP can be adsorbed into soil particles and subsequently be altered to less harmful materials; in deep soils/sediments with very little oxygen, WP may remains stable for years.
- Exposure to WP is primarily due to inhalation and skin contact.

Heavy Metals

- Source of heavy metals is primarily from the disintegration of munitions and mine casing.
- Primary metals of concern are mercury in the form of mercury fuliminate ($Hg\ [OCN)_2$) and lead in the form of lead azide (N_6Pb) and lead styphnate ($PbC_6HN_3O_8$).
- Lead and mercury were primarily used in the initiator charge for munitions and mines.
- Adverse human health effects of heavy metal exposure depends highly on the contamination level, exposure pathway and length of exposure.
- British Columbia soil standards for the protection of human health require that soil contain less than 500 µg/g (dry weight) (BC Waste Management Act 1996).
- British Columbia soil standards define a site as 'contaminated' for agricultural use and residential use if it contains mercury levels in excess of 0.8 µg/g and 2 µg/g, respectively (BC Waste Management Act 1996).

Appendix A2

Long-term Consequences of the Viet Nam War – Ecosystems

Report to the Environmental Conference on Cambodia, Laos and Vietnam

Stockholm, Sweden
July 26-28, 2002

REPORT TO THE
ENVIRONMENTAL CONFERENCE ON
CAMBODIA • LAOS • VIETNAM

LONG-TERM CONSEQUENCES OF THE VIETNAM WAR

ECOSYSTEMS

This is one in a series of reports produced in connection with the Environmental Conference on Cambodia, Laos and Vietnam which was held in Stockholm during 26-28 July 2002. The purpose of the conference was to review the long-term consequences of the Vietnam War, which also afflicted Laos and Cambodia.

Over a quarter-century has elapsed since the war's formal conclusion in 1975, and more than half the current population was born after that date. This means that an entire generation has now grown up in an environment exposed to the massive impact of modern warfare, so that it is now possible to study the long-term implications. Among its other effects, the Vietnam War left a legacy of environmental contamination and destruction that has yet to be thoroughly examined.

That legacy was the focus of the Stockholm conference, and the review of the war's long-term consequences was conducted by subcommittees for each of four main areas: ecosystems; public health; economic and social impacts; ethical, legal and policy issues.

The reports of the subcommittees, all of which are available on the conference web site, may be regarded as initial attempts to deal with highly complex issues for which significant categories of data are often lacking. Furthermore, the resources available for the project were extremely limited.

Accordingly, much remains to be done. It is hoped that the work of the subcommittees will stimulate further study and analysis of the Vietnam War's long-term consequences. All interested parties are welcome to participate in an ongoing discussion of the issues in the Open Forum section of the conference web site at:

www.nnn.se/vietnam/environ.htm

The Environmental Conference on Cambodia, Laos and Vietnam was an initiative of Föreningen Levande Framtid ("Living Future Society"), a Swedish non-profit organization which assembled a steering committee of scientists and other experts to plan and organize the project.

The conference was made possible by financial contributions from Oxfam America, Oxfam Netherlands (NOVIB), Allan & Nesta Ferguson Charitable Trust (England), Swiss-Vietnam Association, American Friends Service Committee, Ford Foundation, Norwegian Red Cross Society, Swiss Red Cross Society, Umverteilen Foundation (Germany) and Sea Otter Productions (Sweden).

Cover illustration: Vo Quy

"The immense destruction brought about by indiscriminate bombing and by the large-scale use of bulldozers and herbicides is an outrage that is sometimes referred to as 'ecocide'. It is shocking that only preliminary discussions of this matter have thus far been possible in the United Nations. . . . We fear that the active use of these methods is coupled with a passive resistance to discuss them."

— from opening address of Swedish Prime Minister Olof Palme to the 1972 U.N. Conference on the Human Environment

Photo: E.W. Pfeiffer

C-123 plane depositing some of the 72 million liters of herbicides sprayed on the fields and forests of Indochina during the Vietnam War.

Long-term Consequences of the Vietnam War

ECOSYSTEMS

THE VIETNAM WAR involved an unprecedented assault on the environment. Vast quantities of bombs, cluster bomb units (CBUs or "bomblets"), napalm, landmines, toxic chemicals, etc. have had lasting effects on soils, water systems, biological diversity, and perhaps even climate. Life forms at many levels of the evolutionary scale have been significantly affected, from primitive plants and animals to human beings.

The extent and intensity of the assault were unprecedented. On an area less than eight percent that of the United States, the amount of high explosives employed was almost double the amount expended by the USA during World War II. Left in the earth were many millions of large bomb craters, unexploded landmines, bomblets, and other ordnance which continue to take a heavy toll of life and limb.

Over 72 million liters of herbicides destroyed roughly ten percent of southern Vietnam's valuable forests, including nearly one-third of the coastal mangroves which play vital roles in coastal ecology and in sustaining fish stocks. Toxic chemicals contained in the herbicides, arsenic and dioxin in particular, are expected to continue posing a significant health threat long into the future.

Altogether, the damage to the environment was so intense and widespread that it gave rise to the term "ecocide". Nearly three decades later, many of the affected ecosystems have still not recovered. The long-term consequences include loss of habitat and biological diversity, severe and persistent problems of public health, enormous economic losses, and severe constraints on human development.

The affected populations have made some progress in restoring the environmental damage from the war. But much more remains to be done, and available resources are very limited. Breaking the war-related cycle of poverty is crucial to the well-being of the present and future generations of Cambodia, Laos and Vietnam. It is an enormous task that will require substantial resources, long-term commitments and appropriate corrective measures.

ASSAULT ON THE ENVIRONMENT

Warfare is a human pastime, the very purpose of which is to subdue an enemy by inflicting overpowering levels of death, destruction, and disruption. Thus, damage to the human environment in time of war— both intentional and collateral— is as old as warfare itself.

The level of savagery is largely independent of the belligerents' level of technological sophistication. Nonetheless, the Vietnam War* of 1961-1975 stands out as the archetypal example of war-related environmental abuse. This negative image is the result of at least five major factors:

(a) the protracted, systematic fury inflicted by one of the belligerents upon the environment of an enemy dependent for its survival on a rural economy based on natural resources

(b) the coincidence of this war with the growing awareness of concern over massive assaults being visited upon the global biosphere in general

(c) the frightening medical consequences of some of the attacks on the environment

(d) the hostile atmospheric manipulations carried out by one of the belligerents, and

(e) perhaps, as well, more generalized moral or ethical objections to this particular war and the way it was pursued by the United States.

The theater of operations of the Vietnam War encompassed portions of Cambodia (18 million hectares, population seven million at the time), Laos (24 million hectares, population three million), North Vietnam† (16 million hectares, population 19 million), and South Vietnam (17 million hectares, population 18 million). Thus, the total for all three countries was 76 million hectares (188 million acres) and 47 million people, the vast majority of whom lived in rural areas. Environmentally, the most disruptive means of U.S. warfare consisted of high-explosive munitions, chemical anti-plant agents, and land-clearing tractors ("Rome plows").

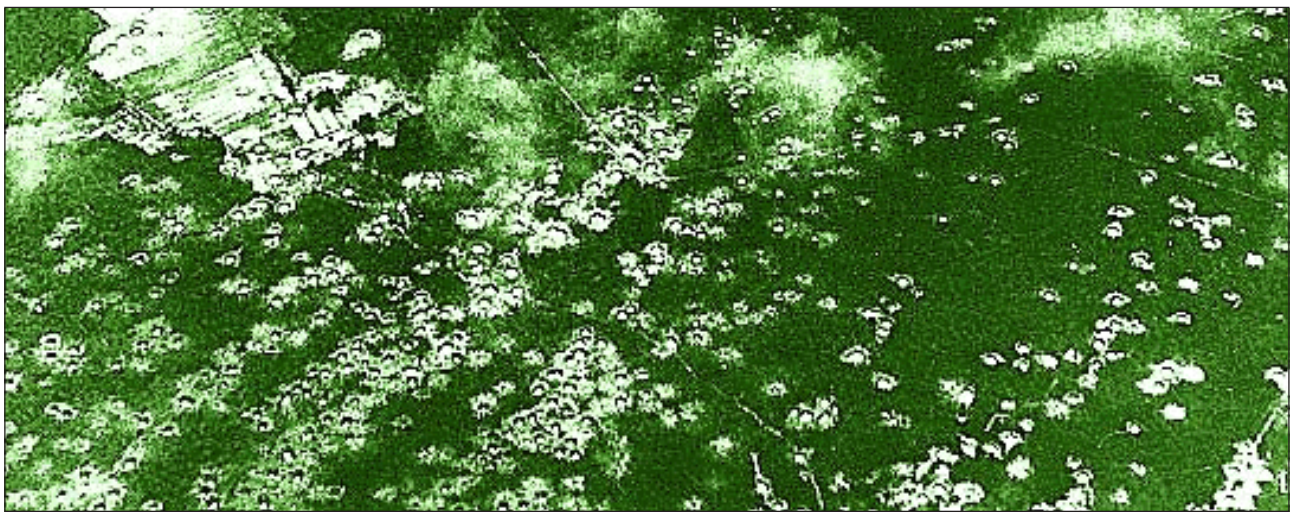
High-explosive munitions

The United States employed some 14 million metric tons of bombs and other high-explosive munitions during the Vietnam War, a truly formidable amount (twice what it had expended during World War II and, in terms of energy released, the equivalent of 328 Hiroshima A-bombs). Of the munitions expended in the region, five percent were used in Cambodia, 16 percent in Laos, eight percent in northern Vietnam, and 71 percent in southern Vietnam — nearly all in rural areas, where 90 percent of the population lived.

These attacks left some 10-15 million large bomb craters as a semi-permanent feature of the landscape in Vietnam, alone. Also left behind

*The Vietnam War is also known as the Second Indochinese War and, in Vietnam, as the American War.

† The division of Vietnam into "North" and "South" was a temporary provision of the 1954 peace agreement which ended the First Indochina War (in Vietnam, the French War). The division ceased to have any legitimacy under international law after the reunification scheduled for 1956 was not allowed to take place.



A portion of the craters resulting from a single B-52 bombing run.
In Vietnam alone, some 10-15 million large bomb craters were left in the landscape.

were many millions of unexploded landmines, bomblets and other unexploded ordnance (UXO) which continue to threaten life and limb throughout the region.

Chemical anti-plant agents

Of the 72 million liters of chemical anti-plant agents sprayed by the United States, less than 0.1 percent was in Cambodia, two percent in Laos, and a negligible amount in northern Vietnam. The remainder, nearly 98 percent, was used in southern Vietnam. Of that amount, 86 percent was directed against forested areas to deny cover to opposing forces; the remaining 14 percent was directed against agricultural lands, primarily for the destruction of rice (both paddy and upland cultivation). These attacks on agriculture were part of a systematic large-scale program of crop destruction and food denial conducted by the USA by a variety of means.

Approximately 14 percent of the total woody vegetation of southern Vietnam was attacked with herbicides. About 13 percent of its inland forests (including rubber plantations) and about 30 percent of its coastal mangrove forests were also attacked, the latter with especially devastating results. Losses of merchantable timber from hostile actions in the inland forests have been estimated at roughly 75 million cubic meters, of which about 20 million can be attributed to the herbicide attacks (although it may be noted that some reports have suggested somewhat higher levels of wartime damage).

Overall, the herbicidal attacks were inflicted upon some ten percent of South Vietnam's total land area (although again it may be noted that some reports have suggested substantially higher values of 24-27 percent).

One of the major chemical anti-plant agents employed, called Agent Orange*, contained trace amounts of the highly toxic substance, dioxin. All told, some 170 kilograms of dioxin were dispersed over the landscape, primarily in rural South Vietnam. To this day, traces of dioxin (TCDD) can still be found in the soil of the most intensively affected areas, for example on the perimeters of some U.S. military installations and at the 50 or more sites where unintended emergency dumping of Agent Orange occurred. Another widely employed herbicide, "Agent Blue", consisted largely of an organic arsenic compound (dimethyl arsenic, or cacodylic acid).

Land-clearing tractors. Three percent of South Vietnam's total forested area, 325 thousand hectares, was scraped bare by the USA with "Rome plow" tractors.

Violation of ethical and legal norms

The assault on the environment of the three affected countries during the Vietnam War violated widely held ethical principles and established legal norms, and evoked a strong response from the international community. The most serious violation was the employment of chemical weapons by the USA, primarily in southern Vietnam. This was seen as a clear breach of the 1925 Geneva Protocol on Chemical and Biological Warfare (LNTS 2138). As of mid-2002, this international agreement, which was developed in response to World War I, had been adopted by 133 of the 193 nation-states of the world (69 percent).

Although the United States was not itself a party to that landmark treaty at the time of the Vietnam War, it defended its use of chemical weapons on the grounds that they were not lethal to human beings. This included the several anti-plant agents and the anti-personnel agent known as 'CS' (*ortho-*

Photo: Hatfield Consultants ltd.

One of the estimated 10-15 million larger bomb craters from the war.

*Agent Orange, which got its name from identifying orange stripes painted on the barrels, was a 50/50 mixture of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) and 2,4-dichlorophenoxyacetic acid (2,4-D). Included in the mixture as an unintentional by-product were trace levels of the dioxin TCDD (2,3,7,8-tetrachlorodibenzo-*para*-dioxin), a substance known to be highly toxic to humans.

chlorobenzalmalononitrile). In 1969, however, a substantial portion of the world community of nations rejected the USA's interpretation, maintaining that those agents were indeed covered by the Geneva Protocol (cf. United Nations Resolution No. 2603[XXIV]A). The United States conceded on this point in 1975 when it became a party to the treaty; its acceptance was qualified by a minor statement on non-combat military uses of herbicides, but this was not a formal reservation.

Another violation of widely held ethical norms was the extensive, severe and long-term environmental damage that the USA inflicted on much of the region comprised of Cambodia, Laos and Vietnam. The affront to these norms, which were just emerging at the time, led to an important qualitative extension of the law of war that was spearheaded by the International Committee of the Red Cross in Geneva. The change took the form of the 1977 Protocol I on International Armed Conflict (UNTS 17512), which for the first time specified constraints on abuse of the environment, *per se* (see especially Article 35.3). As of mid-2002 ,the Protocol had been adopted by 157 of the 193 states (81 percent); the United States is not one of them.

Yet a third affront to ethical norms was a decade-long effort to manipulate the environment, in this case the atmosphere, for military purposes. The program involved cloud-seeding, primarily over Laos, in order to produce heavy rains. This clandestine operation led to yet another extension of the law of war— this time spearheaded by the now-defunct Soviet Union— in the form of the 1977 Environmental Modification Convention (UNTS 17119). However, this treaty has major weaknesses that appear to be recognized by the world community, as indicated by the modest number of states that have adopted it— only 66 of 193, or 34 percent, as of mid-2002. The USA is one of the signatories, but its government has informed its military commanders that the constraints specified in the treaty are essentially meaningless.

Although not of the same character as the three international responses to the Vietnam War referred to above, it may be of interest to note an episode from the 1972 United Nations Conference on the Human Environment. At the insistence of the USA, military disruption of the environment was not included on the conference agenda. But in opening the conference, the prime minister of host country Sweden felt obliged to take the United States to task for its environmentally destructive conduct in Indochina, an action that aggravated diplomatic tensions between the USA and Sweden.

Areas of southern Vietnam sprayed with herbicides at least once during 1965-1971.
(Source: US Dept. of the Army)

The remainder of this report focuses on the consequences of the war for the inland and coastal ecology of Vietnam, the only one of the three affected countries for which significant amounts of data are currently available.

— Arthur H. Westing

INLAND PLANT ECOLOGY

Vietnam has a tropical monsoon climate with two relatively distinct seasons. Its total land area of some 33 million hectares includes a variety of land forms that range from deltas to high mountains. The country is primarily mountainous, with a backbone formed by the Truong Son mountains that run north-south for a distance of some 1,000 kilometers. The highest peaks, located in the north, are over 3,000 meters above sea level. As a result of these wide variations in latitude, altitude, climate and land forms, Vietnam possesses great ecological and biological diversity.

The forest lands that occupy three-quarters of the total land area grow under a variety of topographic conditions, including those associated with mountains, hills and valleys. Forests constitute an integral component of the land and water resources, and are vital to the 24 million people in various ethnic groups who are substantially dependent on forest resources for their livelihoods.

Those resources are abundant: Vietnam has over 10,000 described species of higher plants in 337 genera and 96 families. Among these are over 1,000 species of large trees, including more than 40 rare and valuable timber species.

Non-woody forest products comprise an economically vital component of the tropical forests of Vietnam. Among a wide range of bamboo species, approximately 40 have commercial value. It is estimated that there are some forty species of rattan, the annual harvest of which is now about 50,000 metric tons. Of the more than 1,800 known medicinal plants in Vietnam, two-thirds are found among the natural vegetation— a truly valuable storehouse of natural medicines.

There are an estimated 600 species which provide tannin, 160 so-called essential (volatile aromatic) oils, and 260 other oils. Many of these non-woody forest products are in great demand in local and export markets.

In short, Vietnam is characterized by several types of rain forest supporting an immense range of unique ecosystems that provide a diversity of forest resources.

Decline of natural forest

By 1999 there were 10.91 million hectares of forest in Vietnam, corresponding to 33 percent of the country's total land area. Of this amount, 9.44 million hectares consisted of natural forest, and 1.47 million hectares were plantation forest. In terms of use, 4.04 million hectares (37 percent) consisted of production forest, 1.52 million hectares (14 percent) for special uses such as national parks, nature reserves, etc., and 3.61 million hectares (49 percent) for the protection of watersheds and the prevention of soil erosion. The last-named category also includes forest land that has been set aside for national defense and other purposes.

In terms of species dominance, approximately 77 percent of the 9.44 million hectares in a natural state consisted of tropical and semi-tropical forest, one percent of deciduous forest, two percent of coniferous forest, eleven percent of bamboo forest, and five percent of mixed forest.

As indicated by the accompanying table, there was a steady and quite rapid decline in natural-forest cover between 1943 and 1990. Since 1990, the loss of natural forest has proceeded at

Photo: Hatfield Consultants Ltd

Natural triple-canopy forest of Vietnam

a much slower rate— at an annual average of 36,000 hectares during 1990-1995. At the same time, the area of planted forest increased at an average annual rate of 61,000 hectares. Between 1995-1999, the total area of both natural and planted forest increased rapidly.

Photo: Hatfield Consultants Ltd.

Healthy forests are essential to the welfare of many ethnic minorities.

Wartime damage

During the Vietnam War, the forests of southern Vietnam covered an area of roughly 10.4 million hectares, 60-70 percent of it in the Central Highlands. The United States sprayed over 72 million liters of herbicides on forests (61 million liters) and fields (10 million liters), thereby inflicting environmental damage of varying severity on approximately ten percent of southern Vietnam's total land area. (As noted previously, some reports suggest that this figure may have been as high as 24-27 percent.)

The chemicals were sprayed from the 17th parallel, south to Cape Cau Mau. Most forest types of southern Vietnam were affected. These chemical herbicide attacks, the most extensive in history, substantially depleted the forests that are so important to the sustainable development of Vietnam.

Inland forests, including rubber plantations, were heavily affected by the herbicide attacks, accounting for about 77 percent of total spraying missions. Coastal forests accounted for an additional nine percent, with the remaining 14 percent directed to agricultural lands. In addition, many forest areas were subjected to intense bombing, clearing by tractors and, in some instances, attacks with incendiary bombs.

With regard to altitude, distribution of the spraying was approximately as follows:

- below 300 meters, 16 percent
- 300-700 meters, 42 percent
- 700-1000 meters, 30 percent
- above 1000 meters, 12 percent.

Initial research findings indicate that about 1.4 million hectares of forest land were affected, with countless trees defoliated and destroyed. (Some reports suggest that total area was greater than 2.0 million hectares.) Immediate losses of merchantable timber due to herbicidal attacks were estimated at about 20 million cubic meters (again, some estimates of overall war losses are as high as 90 million cubic meters).

There was also great loss of non-woody forest products. Areas of inland forest where the forest canopy was destroyed have been invaded by secondary tree species or such grasses as *Pennisetum polystachyon* and *Imperata cylindrica*. These invasions have prevented normal forest regeneration. Forest spraying at elevations above

CHANGES IN THE FOREST COVER OF VIETNAM, 1943-1999

1000s hectares

	1943	1976	1980	1985	1990	1995	1999
Natural forest	14,000	11,077	10,486	9,308	8,430	8,252	9,444
Plantation	0	92	422	584	745	1,050	1,471
Total hectares	14,000	11,169	10,608	9,892	9,175	9,302	10,915
% of total area	43.0	33.8	32.1	30.0	27.2	28.1	33.2

Source: Vietnam Ministry of Agriculture and Rural Development. No accurate data available for period from 1943-1976.

700 meters and in areas of steep slopes, especially those with a gradient of more than 25 degrees, had a very serious impact on the absorption capacity of 28 watersheds, with heavy flooding as a result.

Postwar activities

During the period from 1976 to 1995, the natural forests of Vietnam decreased from 11.08 million to 8.25 million hectares, while planted forests increased from 0.09 million to 1.04 million hectares. Since 1995, there has been a substantial growth of awareness regarding the need for forest rehabilitation; the combined efforts of the national government and the general public have yielded positive results. For example, the National Program for Forest Protection and Reforestation during the five-year period from 1993 to 1998 resulted in the following advances on a total of 1.46 million hectares:

- establishment of plantations and the management of protected forests on 640,000 hectares
- preservation of natural regeneration on 700,000 hectares
- establishment of cash crops on 89,000 hectares of sloping land
- establishment of household farms on 31,000 hectares.

Another national program, "Five Million Hectares of Aforestation" has two aims: the regreening of barren lands for watershed protection and the effective conservation of ecosystems, biodiversity and environmental conditions; and returning barren lands to efficient production in order to alleviate poverty and promote sustainable development, especially in mountainous rural areas. As a result of such activities, forest cover in Vietnam has increased from 28 percent in 1994 to 33 percent in 1998.

Despite the passage of more than 25 years since the conclusion of the Vietnam War, its impact on affected forests continues. Areas hard-hit by spraying and bombing are still dominated by such undesirable grasses as *Pennisetum polystachyon* and *Imperata cylindrica*. Examples of such areas include the Aluoi Valley, Sa Thay, Ma Da, and the Boi Loi Woods. Another problem is that natural forests in upland areas are under mounting pressure from commercial logging, and forests of high quality continue to be lost.

It is now clear that the natural restoration of such sites with high-quality trees will be a lengthy process, perhaps taking up to 80 or 100 years. Initial attempts to plant native trees have not been very efficient or effective. Complicated and costly measures will be necessary in order to increase the pace of restoration.

Photo: Hatfield Consultants Ltd.

Removal of the forest has led to widespread erosion, polluting streams and blocking transportation.

Research priorities

Compilation of existing documentation (basic data, aerial photographs, satellite imagery, etc.) from the wartime period, 1961-1975.

Comprehensive surveys of sprayed areas, with a particular focus on areas that were also bombed or otherwise disrupted, in order to produce the documentation required for land-use planning.

Investigation of applicable silvicultural techniques, appropriate tree species (including exotics), and innovative agro-forestry approaches that are suitable for local economic and social conditions.

Needed corrective measures

Rehabilitating the environment and improving the means of livelihood for ethnic minority groups in areas seriously affected by the war.

Forest conservation and replanting in destroyed areas; minimum cost estimated at US$500-800 per hectare.

— Phung Tuu Boi

INLAND ANIMAL ECOLOGY

Prior to World War II, Vietnam was recognized as one of the world's most attractive big-game hunting regions, and its natural environment contains a great wealth of animal life. Recorded to date are 276 mammal species, 830 birds, 180 reptiles, 80 amphibians, 472 freshwater fish, 2038 saltwater fish, and many thousand species of invertebrates. These categories display a high degree of variation, with many local species that are of great scientific and economic value.

Of special interest are such inland species as the elephant (*Elephas maximus*), Javan rhinoceros (*Rhinoceros sondaicus*), banteng (*Bos javanicus*), kouprey (*Bos sauveli*), gaur (*Bos gaurus*), tiger (*Panthera tigris*), gibbon (*Hylobates concolor*), douc langur (*Pygathrix nemaeus*), sarus crane (*Grus antigone*), giant ibis (*Pseudibis gigantea*), white-shouldered ibis (*Pseudibis davisoni*), white-winged wood duck (*Cairina scutulata*), several lophura pheasants (*Lophura spp.*), crested argus (*Rheinardia ocellata*), crocodile (*Crocodilus siamensis*), and python (*Python molurus*).

Vietnam is located in a region of the world that has yet to be studied systematically, which explains why many interesting species have only recently been discovered. These include four large mammals (*Megamuntiacus vuquangensis, Pseudoryx nghetinensis, Muntiacus truongsonensis, Nesolagus temminsi)* and four new bird species (*Lophura hatinhenesis, Garrulax ngoclinhensis, Actinodura sodangorum, Garrulax kongkakingensis).*

Wartime damage

During the Vietnam War, over two million hectares of southern Vietnam's total land area were damaged by various combinations of defoliants, high-explosive munitions, napalm, and land-clearing tractors. The inland tropical forests were especially hard hit. Many animals, including mammals and birds, were killed directly or indirectly by these weapons.

However, the most serious impact was the destruction of ecosystems— including the contamination of soil and water by dioxin and other

Photo: Hatfield Consultants Ltd.

The massive destruction of forests resulted in the disappearance of vital habitats for many animal species. An extensive reforestation program has been implemented since the end of the war. But to plant thousands of hectares of forest is not a simple matter in areas where the soil has been leached and compacted, and where the former life-giving microclimate has been altered by loss of tree cover. In the upper right corner can be seen a small remnant of the original, natural forest.

toxic chemicals— which had provided habitat for forest animals.

Initial investigations showed that forest ecosystems in many of the areas that were repeatedly sprayed were completely destroyed. This includes the dense forests in Ma Da, Phu Binh, Sa Thay, A Luoi, and those along Route 19, which have been replaced by persistent grasses of little value.

Almost three decades have now elapsed since the end of the war, but there are as yet no indications that the destroyed habitats are regenerating naturally. The animal populations are sparse, and very different from those before the war. Thus, the chemical anti-plant agents employed by the United States disrupted natural conditions, converting rich forest ecosystems of great biodiversity into exhausted remnants. Due to the loss of their habitats, many animal species, especially the larger mammals and birds, have become rare or endangered; some are on the verge of extinction.

Postwar activities

Studies have been conducted of natural habitats and the wildlife they support, both in areas that were subjected to military action and in other areas that were not. This has made it possible to evaluate the impact of the war in, for example, Ma Da, Binh Phuoc, the Tay Nguyen high plateau, the Aluoi Valley and the mangroves of the Mekong Delta.

Immediately following the war, the Vietnamese people began an ambitious tree-planting program to regreen the war-scarred land, starting with the mangrove forests and then moving inland. To plant thousands of hectares of forest is not a simple task— especially in areas where the

Endangered Species of Vietnam

Among the endangered birds and mammals of Vietnam are these 21 species:

Douc langur	*Pygathrix nemaeus*
Delacour's langur	*Semnopithecus francoisi delacouri*
Tonkin snub-nosed monkey	*Rhinopithecus avunculus*
Malayan sun bear	*Ursus malayanus*
Clouded leopard	*Neofelis nebulosa*
Tiger	*Panthera tigris*
Indochinese eld's deer	*Cervus eldii*
Kouprey	*Bos sauveli*
Gaur	*Bos gaurus*
Asian elephant	*Elephas maximus*
Javan rhinoceros	*Rhinoceros sondaicus*
Vietnamese pheasant	*Lophura hatinhensis*
Milky stork	*Mycteria cinerea*
Lesser adjustant stork	*Leptoptilos javanicus*
Greater adjustant stork	*Leptoptilos dubius*
Black ibis	*Pseudibis papillosa*
Giant ibis	*Thaumatibis gigantea*
Imperial pheasant	*Lophura imperialis*
Edward's pheasant	*Lophura edwardsi*
Green peafowl	*Pavo muticus*
Crested argus	*Rheinartia ocellata*

Douc langur

Vietnamese pheasant

Crested argus

Recent Discoveries

Much of Vietnam remains relatively unexplored. It was only recently that scientists discovered these two large mammals: *Pseudoryx nghetinensis* (above) and *Megamuntiacus vuquangensis* (right).

soil has been leached and compacted, and where the formerly cool, moist, life-giving microclimates have become hot and dry due to loss of forest cover.

Great efforts have also been made to select and establish a wide range of nature reserves in order to protect most major types of wildlife habitat remaining in the country after the war. There are now over one hundred conservation sites with a combined area of approximately two million hectares, representing six percent of Vietnam's total land area; these include fourteen national parks, a Ramsar wetlands site, and a UNESCO biosphere reserve. The last-named is the Can Go mangrove forest; it was completely destroyed by herbicides during the war, but has now been successfully rehabilitated.

Research priorities

Surveys of areas affected by herbicides in order to monitor natural conditions, long-term effects on animal life, and the gradual re-establishment of animal species. Such surveys are also needed for restoration and land-use planning.

Systematic surveys of flora and fauna in dense primary forests that were not sprayed with herbicides.

Development of appropriate methods for the management of those areas that have been selected for special protection in order to preserve their ecosystems and endangered species.

Needed corrective measures

Environmental restoration in areas that have been seriously affected by herbicides.

Clearing of landmines and other UXO, especially in areas occupied by minority groups.

Helping minority groups to improve their living standards in order to reduce the pressures they now exert on forests and endangered species.

Training of young scientists in habitat restoration and in the conservation of ecosystems, flora, and fauna

— Vo Quy

Photos: E.W. Pfeiffer

Before and after: results of herbicide-spraying on mangroves of Mekong Delta.

COASTAL ECOLOGY

Vietnam has 2,300 kilometers of coastline along the South China Sea and Gulf of Thailand. There are two main deltas, those of the Red River in the north and the Mekong River in the south. The midsection of the country has a rocky or sandy shoreline along the steep slopes of the Truong Son Mountains.

The northeast monsoon creates ocean movements that draw the warm waters of the Japan Current into the South China Sea. The monsoon also carries the north's cool autumn and winter climate southward to Hai Van Pass in Da Nang Province. South of Da Nang, the northeast monsoon results in the dry season, and the intrusion of additional saltwater into estuaries. However, there are no low temperatures to set in motion any vertical circulation of inland waters (autumn overturn).

The southwest monsoon brings a rainy season that lasts for over half the year. This is a time of water runoff and the most rapid vegetation growth in wetland forests, upland tropical forests, and on croplands.

In combination with upstream snowmelt, the rainwater runoff results in annual flooding of the delta floodplains, and greatly expands the Mekong River's discharge plume into the sea. At the interface where freshwater mixes with saltwater, soluble humic-acid matter forms into small particles that provide an abundant source of food for the young of fish, shrimp, and filter-feeders such as shellfish.

In the northern part of the country, the earthen dikes built to prevent flooding by the Red River have for centuries prevented sedimentation on the floodplains. The riverbed is filling up with silt, and the construction of Dinh Vu Dam some twenty years ago has accelerated the sedimentation of Haiphong harbor. The planting of mangroves on coastal wetlands and of Australian pine (*Casuarina equisetifolia*) on sand dunes is now being promoted on suitable sites. Recently, the market economy has created strong demand for the cultivation of tiger shrimp (*Penaeus monodon*).

In the south, the mangroves form a tidal zone on the fringe of the Mekong Delta, while the rear mangroves occupy the inland swamps. These alternate with barren sand bars that are the remnants of previous stages in the seaward sedimentation process.

Rice cultivation is the principle agriculture of Vietnam, and the best growing conditions are on the high tidal flats. With increasing population pressure, the rice fields have been expanding onto the low tidal flats, into the rear mangroves along their less flooded fringes, and along the inland border of the mangroves where there is freshwater during the rainy season.

Houses and fruit-tree gardens have been established on natural riverbanks and on artificial levees along canals. The construction of canals, gates, and dams for new rice fields prevents the natural intrusion of saltwater. The recent large-scale investment in shrimp-farming in brackish water has led to the disruption of coastal ecosystems in general, and of tidal ebb and flow in particular.

For the past 300 years, canals have been built to connect the nine branches of the Mekong Delta with adjacent rivers in order to form a network of waterways for transportation, as well as

an irrigation and drainage system for agriculture. The inward tidal flows create "no-flow" points within the network of waterways.

In the wetland depressions, the no-flow sites have functioned as natural nurseries where particulate matter and juvenile marine organisms collect. Now, the no-flow sites are also collecting pollutants from upstream sources and the residue of oil spills from offshore tanker accidents.

The annual rainy season of eight months is the prime time for juvenile marine organisms to migrate to their nurseries in the brackish pools of the mud flats and lagoons, and for mature individuals to move toward their spawning grounds offshore.

Wartime damage

The military defoliation of inland regions during 1961-1971 damaged or destroyed huge areas of upland forest in the river drainage basins, leading to extensive soil erosion. Dioxins and other pollutants from the entire Mekong River watershed ended up in sediments deposited in the wetland and rear mangroves of the estuaries.

Military defoliation operations along the coast during that period completely destroyed about 41 percent of the true mangroves, and about 14 percent of the rear mangroves. This had the effect of rapidly increasing the amount of organic matter and other detritus in the brackish tidal pools where marine organisms establish their nurseries.

The denuded wetlands became free-fire zones during the war, thus denying the local populace access to their traditional natural resources and small-scale rice production, while at the same time leading to steady deterioration of coastal habitats in general. An alternate source of income was soon discovered in the harvesting of brackish-water shrimp, which had become more abundant due to the increased supply of detritus. Local residents began to impound small pools of water to increase production, but this also impeded the natural ebb and flow.

With the tree canopy removed, clam populations in mud flats were exposed to direct sunlight and died off. They were replaced by populations of *Upogebia spp.*, a type of shellfish whose burrow has a mound of mud around the entrance. On these slight elevations above the water surface grows the giant fern, *Acrostichum aureum*, which acts as a sediment trap. In this way, the mud flats that once served as nurseries for the juveniles of marine organisms rapidly fill up with sediment. This appears to be an irreversible degeneration of the habitat.

Generally, the loss of nurseries for marine organisms along Vietnam's entire seacoast with the South China Sea has led to reductions in populations of marine fishes. The loss of valuable resources from the estuaries has led to overexploitation by the local populace, which in turn has impeded the regeneration of mangroves and thereby aggravated problems of poverty and hunger. Many individuals and families thus affected have migrated to the cities, where they have settled as squatters along the canals. Their marginalization in this era of globalization is a tragedy for them and a severe impediment to urban development.

Postwar activities

Soon after the war, the local populace began to harvest the trunks and roots of dead trees to sell as firewood. The demands on coastal lands were substantial: rice fields were established wherever possible; evaporation saltbeds were established on barren land; and *Rhizophora* mangroves were

Photo: E.W. Pfeiffer

Mangrove after spraying.

replanted on tidal mud flats. Natural regeneration of pioneer plants occurred along river banks, especially in rivermouth sediments.

The depleted monkey population recovered naturally, and small clupeid fishes returned to spawn. In the 1980s, the farming of peneid shrimp in the Rung Sat mangroves was expanded by enlarging the water impoundments in tidal inlets. This has had the effect of further reducing the available amount of mangrove habitat, which is essential to the welfare of numerous land and marine organisms, including both freshwater and saltwater fish. The decline of the estuaries' natural resources on which the local people depend has led them to overexploit the mangroves, and the expansion of aquaculture may have destabilized the local microclimate.

The largest of several new reservoirs was formed in 1986 by the Tri An electric power dam, which altered both natural downstream flows and the pattern of saltwater intrusions. This resulted in the disruption of ecosystem relations between salt and freshwater, vegetation, and animal life in the tidal flats. From the Rung Sat estuaries, the spring-tide fish run was nearly depleted at the Soai Rap outlet. There has been a steady decline of natural seeding of fish from the sea.

New techniques for treating polluted brackish waters and managing the hatching of tiger shrimp larvae have led to a huge expansion of semi-intensive shrimp-farming in mangroves— and even on sandy barren lands along the rocky coasts of central Vietnam.

Since 2001, shrimp-farming in the Mekong Delta has been increasing steadily and is expected to extend over 700,000 hectares by 2005. Since their inception a decade ago, shrimp hatcheries have been contaminating the waters of Nha Trang with bacterial and virus diseases. Epidemic shrimp diseases covering areas larger than 20,000 hectares are now often reported. Such diseases have occurred in the rear mangroves, and have been attributed to the leaching of insecticides originating from rice fields. Epidemic shrimp diseases are also occurring in mangrove areas dominated by semi-intensive farming.

During the past three years, significant damage has been caused by altered flood cycles and water levels, in both the Mekong Delta and the estuaries of the smaller rivers which empty into the sea along the central coast of Vietnam. Typhoons associated with *El Niño* have led to heavy flooding of deforested upstream areas in the Truong Son Mountains, and also to large-scale coastal erosion.

Research priorities

Monitoring the watersheds of shorter rivers in central Vietnam in order to provide a scientific basis for minimizing typhoon-related flood damage and coastal erosion.

Monitoring the entire lower basin of the Mekong River, especially the wetland forests with brackish-water fish nurseries, in order to provide a scientific basis for achieving sustainable use.

Determining the capacity of Cambodia's great Tonle Sap Lake to serve as a flood-control reservoir and as a sanctuary for inland freshwater fish.

Determining the persistence of dioxins and polychlorinated biphenyls (PCBs), and their accumulation in food chains.

Interdisciplinary research with emphasis on restoration and development of affected ecosystems.

Needed corrective measures

Empowerment of stakeholders, including those who have been displaced by the deterioration of natural ecosystems.

Restoration programs, including the design and implementation of new techniques to minimize the negative effects of shrimp-farming for global markets, and education of the local populace to avoid overexploitation of remaining resources.

Restoration of the natural nurseries of marine organisms in tidal wetlands as a complement to current emphasis on restoration of vegetation.

— Bui Thi Lang

CONCLUSION

Alterations of the earth's ecosphere are part of an ongoing process that is increasingly influenced by human activities, of which warfare is among the most destructive. Its negative impact is reflected at virtually all levels of evolution— from simple one-celled organisms to higher plants and human beings.

The concept of "ecocide" was a product of the Vietnam War. In addition to the human suffering it inflicted, the destruction caused by the war to plants, animals and their habitats was unprecedented in scale and intensity. Much of that destruction resulted from the intentional targeting of ecosystems that were thought to provide shelter and support to opposing forces.

These military attacks on the environment, which were conducted on a massive scale for many years, was highly systematic and led to the destruction of entire ecosystems in large areas of Vietnam. Among the means employed were high-explosive munitions, napalm, landmines, chemical herbicides, mechanical land-clearing, and even cloud-seeding. They all resulted in immediate and long-term impacts on the soils, nutrient balance, hydrological regimes, plants, animals, and perhaps even the climates of Cambodia, Laos and Vietnam.

Photo: Dave McCracken

Tens of millions of hand and rifle grenades, mines, mortar shells and other UXO remain in the landscape, posing a constant threat to all life, and eliminating large areas of valuable land from production.

Perhaps the most profound ecological impact was on the forests of Vietnam. The loss of a significant proportion of southern Vietnam's forest cover triggered a number of related effects. For example, loss of timber led to reduced sustainability of ecosystems, decreases in the biodiversity of plants and animals, poorer soil quality, increased water contamination, heavier flooding and erosion, increased leaching of nutrients and reductions in their availability, invasions of less desirable plant species (primarily woody and herbaceous grasses), and possible alterations of both macro- and microclimates. Chemical agents used during the war also had devastating impacts on the agricultural sector, especially rice cultivation, and on fisheries— in the latter case, primarily through destruction of vital mangroves.

The environment of Vietnam is struggling to recover from the effects of these human interventions. Understanding the causes of environmental degradation is an important challenge that involves both wartime and postwar factors. For example, the illegal logging taking place today poses a significant obstacle to the development and maintenance of a strong, ecologically sustainable forestry sector. There is a need for monitoring and control mechanisms that will support and encourage environmental sustainability in combination with sound economic development.

Cycle of poverty

A significant proportion of the Vietnamese population is trapped in a cycle of poverty which is aggravated by environmental degradation, widespread health problems, rapidly increasing numbers and unfavorable economic conditions. These factors are strongly linked to the Vietnam War and its persistent consequences.

Restoration of the war-ravaged environment is a matter of particular urgency, since well-functioning ecosystems are essential to human health and the reduction of poverty. With regard to just one long-term consequence of the war, Alastair McAslan has observed that, "It is now universally recognized that mine action is not just about de-mining; it is about reducing the social, economic and environmental impact of mines. It is about people and societies, and their interaction with land contaminated by mines and UXO."

The dangers of landmines, other UXO and chemical contamination have effectively removed large tracts of valuable land from production. Ecosystems damaged by the war are no longer able to support local communities, which have thereby become impoverished.

In many areas, for example, application of herbicides has transformed what were once rich triple-canopy forests into grasslands of little economic or ecological value. With the forest cover removed, erosion has become widespread and the resulting landslides often block transport routes to markets, further aggravating the cycle of poverty.

Death and injury caused by landmines and other UXO can have devastating repercussions, especially when the victims are family breadwinners. Trauma, anxiety and other disorders all combine to intensify the grip of poverty on individuals, families and communities. So do the effects of contaminated food and water, malnutrition and disease. The close relationship between poverty and ill health is well-established.

Breaking this war-related cycle of poverty is crucial to the well-being of the present and future generations of Cambodia, Laos and Vietnam. It is an enormous task that will require substantial resources, long-term commitments, and corrective measures that are sensitive to both social and cultural factors.

There is also a need for research in a number of areas to provide a solid basis for suitable programs of preservation and restoration. Among the highest priorities for future research are: the collection and assessment of ecological data from the wartime period; comprehensive surveys of the flora and fauna in relatively untouched areas and comparable surveys in war-impacted areas; reforestation alternatives; agricultural assistance; studies of watersheds, flooding and erosion; fisheries enhancement; and the chemical contamination of food resources which may be linked to specific Agent Orange "hot spots", such as those associated with some former U.S. military installations, emergency dump sites and spray-plane crash sites.

Photo: Hatfield Consultants Ltd.

Needless to say, such research priorities must be meaningfully related to corrective measures for habitat rehabilitation, clearing of landmines and other UXO, improvements in the living standards of local populations, reforestation, soil stabilization, and the restoration of aquatic habitats with their associated organisms.

Finally, it is essential that those who are most directly affected by the long-term consequences of the Vietnam War be provided with sufficient resources to understand and implement programs for healing and restoring the ravaged environment. Only in this way will it be possible to overcome the terrible legacy of the war.

— L. Wayne Dwernychuk

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SUBCOMMITTEE ON ECOSYSTEMS

Dr. Arthur H. Westing

Dr. Westing is a forest ecologist who was among the first to study the environmental effects of the Vietnam War on the forests and fields of the then south Vietnam and is regarded as a pioneer in the field. In the course of that work during the 1970s, he became familiar with the ecological and public health implications of the chemical deforestation program. He now operates an environmental consultancy firm in the United States, but has followed developments in Vietnam since the days of his field work there.

Phung Tuu Boi

Mr. Boi is Director of the Nature Conservation and Community Development Center in Hanoi, and is also on the staff of the Forest Inventory and Planning Institute (FIPI). For the past three decades, he has studied the effects on forests of herbicides and defoliants used during 1961-1971 in the Vietnam War. He has also prepared forest development plans for sprayed areas in southern Vietnam.

Prof. Vo Quy

Professor Quy is currently President of the Center for Natural Resources and Environmental Studies at the National University of Vietnam in Hanoi. An ornithologist by training, "the smiling professor" began studying the effects of massive defoliation on the forest ecology of southern Vietnam during the war. Since then, he has played a leading role in a national programme to conserve natural resources and promote biological diversity.

Dr. Bui Thi Lang

A forester's daughter who grew up in the wetland and upland forests of southern Vietnam, Dr. Lang is a marine biologist who played a key role in wartime studies of defoliation which established the presence of dioxin contamination in fish and mothers' milk. She has also led major studies of coastal mangrove swamps and the wetlands of the Mekong Delta. In addition, she has worked with social scientists on studies of urbanization, ecological problems and sustainable development in marginal housing areas along the tidal canals of Ho Chi Minh City.

Dr. L. Wayne Dwernychuk

Dr. Dwernychuk is an environmental scientist with Hatfield Consultants Ltd. in Canada (HCL), and has been actively involved in that organization's studies on the effects of Agent Orange and related issues in Vietnam. That work has included sample-collection in Vietnam, serving as principal technical author of two HCL reports on Agent Orange impacts, and publication on Agent Orange/dioxin in the scientific journal, *Chemosphere* (see references).

LONG-TERM CONSEQUENCES OF THE VIETNAM WAR

ECOSYSTEMS

The Vietnam War involved an unprecedented assault on the environment. Vast quantities of bombs, cluster bombs, napalm, landmines, toxic chemicals, etc. have had lasting effects on soils, water systems, biological diversity, and perhaps even climate. Life forms at many levels of the evolutionary scale have been significantly affected, from primitive plants and animals to human beings.

The damage to the environment was so intense and widespread that it gave rise to the term "ecocide". Nearly three decades later, many of the affected ecosystems have still not recovered. The long-term consequences include loss of habitat and biological diversity, severe and persistent problems of public health, enormous economic losses, and severe constraints on human development.

This report to the Environmental Conference on Cambodia, Laos and Vietnam analyzes those consequences, suggests priorities for future research, and proposes a variety of measures to deal with the continuing aftermath of the war.

www.nnn.se/vietnam/environ.htm

Appendix A3

International Mine Action Standards – Guidelines to Mine Clearance Activities

IMAS 08.10

First Edition
2001-10-01

General mine action assessment

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Contents

Foreword

In July 1996, international standards for humanitarian mine clearance programmes were proposed by working groups at a conference in Denmark. Criteria were prescribed for all aspects of mine clearance, standards were recommended and a new universal definition of 'clearance' was agreed. In late 1996 the principles proposed in Denmark were developed by a UN-led working group into *International Standards for Humanitarian Mine Clearance Operations*. A first edition of these standards was issued by the UN Mine Action Service (UNMAS) in March 1997.

This second edition reflects changes to operational procedures, practices and norms that have occurred over the past three years. The scope of these standards has been expanded to include the other components of mine action, in particular those of mine risk education and victim assistance.

The United Nations has a general responsibility for enabling and encouraging the effective management of mine action programmes, including the development and maintenance of standards. UNMAS is the office within the United Nations Secretariat responsible for the development and maintenance of international mine action standards (IMAS).

The work of preparing, reviewing and revising these standards is conducted by technical committees, with the support of international, governmental and non-governmental organisations. The latest version of each standard, together with information on the work of the technical committees, can be found at http://www.mineactionstandards.org/. IMAS will be reviewed at least every three years to reflect developing mine action norms and practices, and to incorporate changes to international regulations and requirements.

Introduction

Planning for mine action requires accurate and timely information on the form, scale and impact of the threat posed by mines, UXO and other explosive hazards. Such information will come from assessment missions and surveys, from ongoing local mine action projects and tasks, and from local information.

For new programmes, the planning process should ideally start with a formal country-wide assessment of the country situation. This assessment will draw heavily on existing information provided by agencies and organisations familiar with the mine-affected country or region. If requested a UN multi-disciplinary assessment team will deploy to the country to validate and update existing information, and to determine at first hand the scale and impact of the landmine situation. The country assessment should determine whether a UN-supported national mine action programme is required, whether such a programme is possible, or what other action is required. It may also define the scope of additional information gathering requirements.

Should a decision be taken to develop a national mine action programme, it will be necessary to conduct a comprehensive assessment of the mine-affected country. Existing programmes should also begin the general mine action assessment process as early as possible. The aim of the general mine action assessment is:

a) to assess the scale and impact of the landmine problem on the country and individual communities;

b) to investigate all reported and/or suspected areas of mine or UXO contamination, quantities and types of explosive hazards; and

c) to collect general information such as the security situation, terrain, soil characteristics, climate, routes, infrastructure and local support facilities, to assist the planning of future mine action projects.

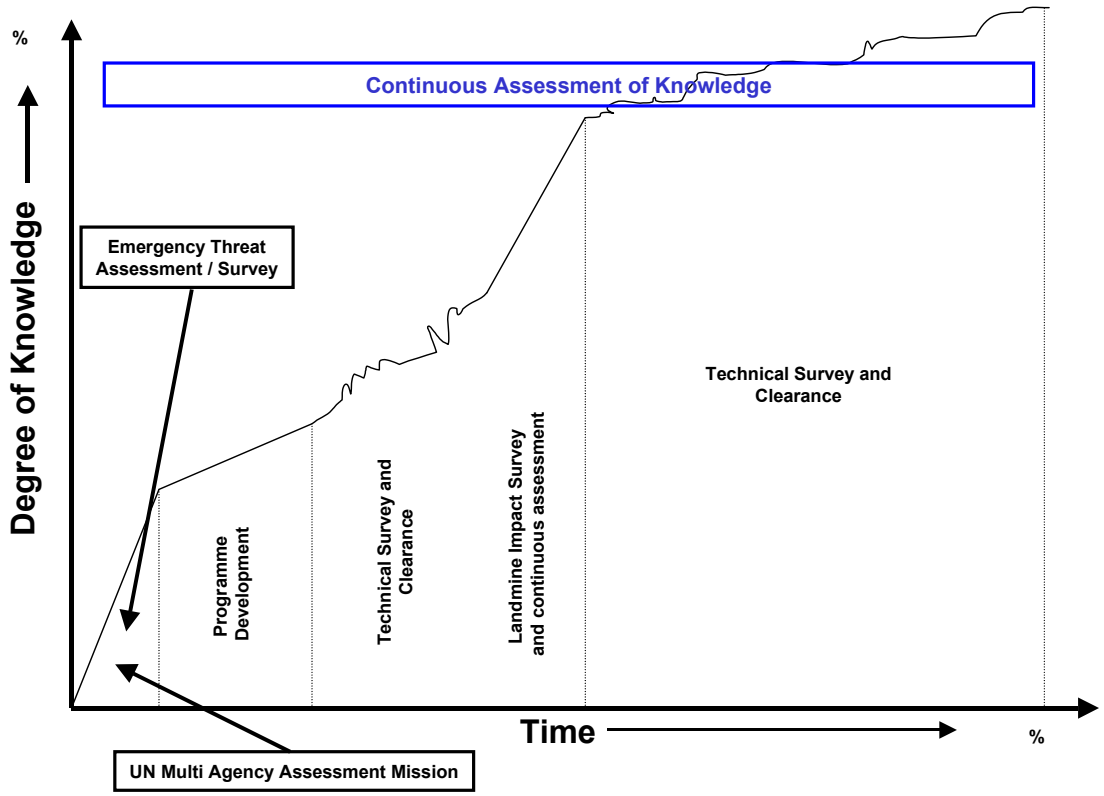
The general mine action assessment process gathers information on national capabilities and potential to address the problem, and the need for external assistance including financial, human skills, material and information. The information collected should be sufficient to enable priorities to be established or updated and plans to be developed. It is a continuous process.

The previous “mine clearance standards” implied a sequential Level 1, Level 2 and Level 3 process; this was not always achieved or practiced; a general mine action assessment is more complex that that. More often the processes of a general mine action assessment require the use of complementary skills and procedures.

Technical Survey, an Impact Survey and the Post Clearance Inspection and Sampling functions are still functional areas of the overall general mine action assessment; they are covered as separate IMAS or TNMA for ease of use and simplicity during technical operations.

For the purposes of this IMAS an “assessment” defines a continually refined process of information gathering and evaluation”, whereas “a survey” is a distinct operational task capable of being contracted.

The following diagrammatic is a possible illustration of the functional flow during a general mine action assessment in a mine affected country:



General mine action assessment

1 Scope

This standard establishes principles and provides guidance on the requirements of the general mine action assessment process, and details responsibilities and obligations.

2 References

A list of normative references is given in Annex A. Normative references are important documents to which reference is made in this standard and which form part of the provisions of this standard.

3 Terms and definitions

A list of terms and definitions used in this standard is given in Annex B. A complete glossary of all the terms and definitions used in the IMAS series of standards is given in IMAS 04.10.

In the IMAS series of standards, the words 'shall', 'should' and 'may' are used to indicate the intended degree of compliance. This use is consistent with the language used in ISO standards and guidelines.

a) 'shall' is used to indicate requirements, methods or specifications which are to be applied in order to conform to the standard.

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The term 'national mine action authority or authorities' refers to the government department(s), organisation(s) or institution(s) in each mine-affected country charged with the regulation, management and co-ordination of mine action. In most cases the national mine action centre (MAC) or its equivalent will act as, or on behalf of, the 'national mine action authority'. In certain situations and at certain times it may be necessary and appropriate for the UN, or some other recognised international body, to assume some or all of the responsibilities, and fulfil some or all of the functions, of a national mine action authority.

4 General mine action assessment – purpose and scope

The purpose of a general mine action assessment is to continually gather, evaluate, analyse and make available sufficient information to assist and update the strategic planning of a national mine action programme. It should provide a source of continually updated data on the nature and extent of the hazards and hazardous areas, the impact of such hazards at community and country level, and other important planning information such as local soil characteristics, vegetation and climate, and safe access routes and local facilities such as water and medical support. The general mine action assessment should also provide an inventory of national capabilities and potential to implement national mine action projects, and to support the work of external organisations and agencies.

The scope and extent of the general mine action assessment depends on many factors, including the availability of (and access to) existing information, the local security situation, and the human and financial resources available. Its scope and thoroughness will also depend on the urgency and need for planning information. The process of gathering information carried out in the early stages of an emergency programme will be quite different in form and detail to those conducted as part of a more stable developmental mine action programme.

5 General principles

Although general mine action assessments will vary significantly in terms of scope, complexity and duration, four general principles apply:

a) the general mine action assessment forms part of a national mine action programme, or in some cases, (on a limited scale) may, precede a national mine action programme. It should therefore be controlled by the national mine action authority, or by an agency or organisation acting on behalf of the national mine action authority. The national mine action authority should normally be custodian of the data, reports and related products such as maps;

b) the general mine action assessment is not merely a 'snap-shot' of the situation on a particular date. It is a continuous process which aims to collect and to refine relevant information. As such, a general mine action assessment should use systems and methods which are robust and sustainable;

c) government departments, UN agencies, NGOs, commercial demining contractors and other organisations operating within a mine-affected country shall assist the general mine action assessment by providing access to information, and by giving practical support, if needed. This requires a unity of purpose and effort, and a willingness to cooperate – or at least not to hinder the work of staff gathering information for the general mine action assessment; and

d) whenever possible, information collected during the general mine action assessment should not be restricted or sensitive. The use of unclassified material will assist and encourage the wide distribution of survey reports, maps, data and assessments. But there will be occasions when information is provided with national security implications, and with restrictions on its further distribution. Such information may be provided by national authorities who perceive the information to have some military security value, or by members of former warring factions or others who wish to remain anonymous. The use of such information, and its exploitation, should be considered by national mine action authorities n a case-by-case basis. Where information collected is not sensitive or restricted it should be made widely available to all stakeholders.

e) Throughout the general mine action assessment process, major principles of mine action, such as capacity building and information sharing should always remain a major priority.

6 General mine action assessment – the process

6.1 Planning and preparation

Careful planning and preparation is essential in order to ensure that the general mine action assessment objectives can be achieved with the resources available and in a timely manner. All possible sources of information should be considered. Survey or assessment teams will provide the principal sources of information.

Local information gathering teams may not exist and will need to be established, trained, equipped and briefed. Valuable information may also be obtained from 'technical' sources such as satellite images, aerial photographs, military dossiers and hospital records. Special arrangements should be established and procedures should be developed, including the use of liaison officers to improve access to such information and data collection techniques and methodologies for collection.

The relationship between the three categories of information (the mine/UXO threat, its impact and general planning data) should be addressed fully during the planning stage. It will normally be appropriate to collect all three categories of information at the same time, but in such circumstances the specialist skills needed to analyse and interpret the different sets of data must be included in the joint project team.

6.2 Collection

The second stage involves the collection of information. Wherever possible the original documentation (such as maps, minefield records, questionnaires, interview notes and satellite imagery) should be retained, although additional information may be added for clarity or amplification. However, no formal attempt should be made at this stage to analyse or interpret the information as this may lead to early and false deductions being drawn from an incomplete set of data; and these deductions may, in turn, influence the way in which the remaining information is collected and interpreted. (The teams will obviously be sensitive to the information they obtain, and may need to act on such information in order to save life or improve operational efficiency).

The type and detail of the data collected will vary, and should be appropriate to its intended use. There will be the obvious constraints of time and resources, but the general mine action assessment should aim to implement as comprehensive a system of data collection as early as possible.

The general mine action assessment shall, inter alia, collect information on:

a) the numbers, locations and livelihoods of communities at risk and otherwise affected by the presence, or perceived presence, of mine and UXO hazards. This should include details such as access to drinking water, housing and shelter, productive land, roads and infrastructure. It should identify the numbers and demography of mine victims and survivors, and the availability of victim assistance. It should include an assessment of the ability of the affected communities to cope and adapt to the threat. Guidelines on the collection, collation and subsequent evaluation of such information (the 'impact' survey) will be given in Technical Notes for Mine Action (TNMA) 08.10 series;

Note: The United Nations subscribes to the methodology of the impact component of the general mine action assessment in TNMA 08.10 series. In order to enable a consistent, global picture to be developed of the impact of landmines on communities, the UN will certify those surveys conducted in accordance with this methodology. Certification guidelines will be applied using quality assurance monitors.

b) the extent of the national mine and UXO threat, in order to assess the amount and type of resources needed to remove (or at least to reduce) the risk through hazard marking, risk education and education, and/or clearance;

c) the approximate location and extent of each suspected or confirmed hazard area in order to locate it safely and quickly at some later stage, in order to conduct a technical survey and/or clearance;

d) the local terrain including ground profile, soil type, soil contamination (mineral and scrap metal), drainage, vegetation (type and density) and access, in order to describe in general terms the technical factors which will influence the resources required for clearance; and

e) the mine and UXO types and density. The detail collected as part of the general mine action assessment need only be sufficient to assess in general terms the resources required for clearance. More detailed information on the density and depth of the mines and UXO in each hazardous area shall be collected during the technical survey, (should one be conducted). Furthermore, personnel conducting such general assessments are unlikely to be trained or equipped to enter suspected mined areas, so the nature and accuracy of the information sought should be commensurate with the resources available.

f) the APM stockpile situation. This should include quantities, locations, stability in storage, storage conditions, technical data and any proposed destruction methodologies.

The general mine action assessment should also collect information on:

a) the condition and potential of the local infrastructure, including logistic facilities, transportation, communications and medical facilities) which could be used to support technical survey and/or clearance projects.

b) the availability of suitable local staff for employment as deminers, support staff and management.

c) the local climate (rainfall, temperature and humidity) and its potential impact on technical survey and/or clearance projects.

The information should be collected in a systematic manner. Wherever possible use should be made of standard and proven information management systems and GIS, such as the Information Management System for Mine Action (IMSMA). Guidance on the use of IMSMA data collection sheets as part of the general survey process is given in Annex C.

6.3 Collation and evaluation

Collation is the procedure for receiving, sorting and recording all information collected from all sources, both planned and unplanned. A collation system should be simple to operate and maintain, and require minimum staff effort. Wherever possible use should be made of standard and proven information management systems and GIS, such as IMSMA.

Evaluation occurs concurrently with collation. It involves the assessment of each piece of information as it is received for its relevance, accuracy and duplication. Obvious errors such as transposed grid references should be corrected.

Each source of information should be assessed in terms of its proven reliability and credibility. It is most important to reduce uncertainty and to correct inaccuracies at this stage. Inaccurate and misleading data will impact on later stages of the process, and may reduce confidence in other (and more accurate) information collected during the survey. Greater effort at this stage enables resources to be focused more effectively on follow-on activities such as mine risk education, technical survey and clearance projects.

Organisations should remain vigilant to the risk of database 'contamination' with unsubstantiated information. A system of credible verification of information must be adopted in order to avoid unnecessary clearance operations for land that should never have been classified as mine affected in the first place.

6.4 Analysis, integration and interpretation

Analysis involves the detailed examination of each piece of information, once it has been evaluated, to identify significant facts and to draw appropriate conclusions. At this stage it may be considered necessary to revisit the source of information to confirm its accuracy or completeness.

Integration involves the detailed examination of two or more pieces of information to establish patterns and to draw conclusions. Examples are the integration of aerial photographs showing evidence of significant military activity, with unconfirmed reports from local communities; or the integration of information from bomb-damage assessment folders with UXO-casualty data.

Interpretation is a systematic process which leads to deduction. It relies on experience, professional judgement and an understanding of the local context in which the data was collected. New information is compared with what is already known or suspected. This may increase confidence in the reliability of a source of data, or it may raise new questions or uncertainty.

Effective analysis, integration and interpretation requires specialist skills such as photographic/imagery interpreters, linguists and experienced deminers. Such skills may be in short supply and will take time to obtain suitably qualified specialists.

This stage of the process should be well documented with assumptions clearly stated and reasons given for all deductions and conclusions. This provides an 'audit trail' which can be re-visited should new information become available or should assumptions subsequently be challenged, revised or refined.

6.5 Dissemination

Dissemination involves the publication of the information collected during the general mine action assessment process so that it can be readily and easily used and exploited. The form and means of dissemination should have been agreed at the start of the survey, but may need to be revised to reflect changing requirements such as the handling of restricted information.

Information should be made available in a form which is appropriate for its local use and exploitation, and subsequent review. This may include reports, summaries, maps, verbal briefings and electronic media. Whenever possible, use should be made of standard and proven information management systems and GIS, such as IMSMA.

6.6 Review

The general mine action assessment is not an end in itself. As stated earlier, it should normally be subject to continuous review with new information being added, and the implication(s) of that information being adequately addressed. In particular, changes to assumptions and to the reliability of sources of information should be revisited on a regular basis, and the implication(s) of these changes examined fully.

7 Mine Ban Treaty surveys

Article 7.1 of the *Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-personnel Mines and on their Destruction* (commonly known as the Ottawa Convention or Mine Ban Treaty) requires each State Party to report annually to the United Nations '…. to the extent possible, the location of all mined areas that contain, or are suspected to contain, anti-personnel mines under its jurisdiction or control, to include as much detail as possible regarding the type and quality of each type of anti-personnel mine in each mined area and when they were emplaced.' The UN Department of Disarmament Affairs (DDA) provides guidance on the level of detail required, the form in which it should be provided, and the reporting schedule.

States Party who are required to provide information to DDA in accordance with Article 7.1 of the Mine Ban Treaty should consider using the general mine action assessment process to collect, collate and present the necessary information on mined areas which contain, or are suspected to contain, anti-personnel mines.

8 Responsibilities and obligations

8.1 United Nations

The United Nations assesses and monitors the global landmine threat and its impact with a view to identifying needs and developing appropriate responses. This is accomplished through inter-agency and multi-disciplinary assessment missions, and by providing support the general mine action process.

The United Nations has a general responsibility for ensuring the establishment of a regime conducive to the effective management of mine action programmes. This includes mine action standards, including this standard. It also includes IMSMA which is the information management system preferred by the United Nations for use in all new mine action programmes, including the general mine action assessment.

8.2 National mine action authority

The national mine action authority is responsible for the regulation, management and coordination of mine action in a mine-affected country, and for ensuring the national and local conditions which will enable the effective management of demining projects.

The national mine action authority is ultimately responsible for all phases of a demining project within its national boundaries, including the general mine action assessment. In particular, the national mine action authority shall establish and maintain a system and procedures for the collection, collation, analysis and dissemination of information on the mine and UXO threat and its ongoing impact.

8.3 Demining organisations

Where the national mine action authority is in the process of formation, such demining organizations are well placed to assist the formation process, by giving advice and assistance including the framing of national standards.

Until the formation of the national mine action authority, the demining organization should assume its responsibilities.

Where mine/UXO information is available to demining organisations, this information should be freely made available to the National Mine Action Authority or others involved in the general mine action assessment process.

Annex A
(Normative)
References

The following normative documents contain provisions, which, through reference in this text, constitute provisions of this part of the standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of the standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid ISO or EN:

a) IMAS 05.10. Information systems and communications

The latest version/edition of this reference should be used. GICHD hold copies of all references used in this standard. A register of the latest version/edition of the IMAS standards, guides and references is maintained by GICHD, and can be read on the IMAS website (www.mineactionstandards.org). National mine action authorities, employers and other interested bodies and organisations should obtain copies before commencing mine action programmes.

Annex B
(Informative)
Terms and definitions

B.1.1. GIS
Graphical or geographic information system
An organised collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyse, and display all forms of geographically referenced information.

B.1.2.
IMSMA
the Information Management System for Mine Action (IMSMA)

Note: This is the United Nation's preferred information system for the management of critical data in UN-supported field programmes and at the UN headquarters in New York. IMSMA consists, essentially, of two modules: the Field Module (FM) and Global Module (GM). The FM provides for data collection, information analysis and project management. It is used by the staffs of mine action centres at national and regional level, and by the implementors of mine action projects - such as demining organisations. The GM refines and collates data from IMSMA FMs (and other field-based information systems) and provides the UN and others with accurate, aggregated information for the strategic management of mine action.

B.1.3.
national mine action authority
the government department(s), organisation(s) or institution(s) in each mine-affected country charged with the regulation, management and co-ordination of mine action.

Note: In most cases the national mine action centre (MAC) or its equivalent acts as, or on behalf of, the 'national mine action authority'.

Note: In certain situations and at certain times it may be necessary and appropriate for the UN, or some other recognised international body, to assume some or all of the responsibilities, and fulfil some or all of the functions, of a national mine action authority.

B.1.4.
technical survey

Note: previously referred to as a Level 2 survey

the detailed topographical and technical investigation of known or suspected mined areas identified during the planning phase. Such areas will have been identified during the general mine action assessment or have been otherwise reported.

Annex C
(Informative)
Guidance on the use of IMSMA for the general mine action assessment

IMSMA. The Information Management System for Mine Action (IMSMA) is the United Nation's preferred information system for the management of critical data in UN-supported field programmes and at the UN headquarters in New York. IMSMA consists, essentially, of two modules: the Field Module (FM) and Global Module (GM). The FM provides for data collection, information analysis and project management. It is used by the staffs of mine action centres at national and regional level, and by the implementors of mine action projects - such as demining organisations. The GM refines and collates data from IMSMA FMs (and other field-based information systems) and provides the UN and others with accurate, aggregated information for the strategic management of mine action.

General mine action assessment. The general mine action assessment is the collection, collation, analysis, interpretation and dissemination of information on the mine and UXO threat and its impact in order to assist the planning of mine action projects. The general mine action assessment provides a source of accurate and reliable information on the nature and extent of the hazards and hazardous areas on mine-affected communities, and other important planning information such as local soil characteristics, vegetation and climate. IMSMA enables the User to enter, store and retrieve the information from such investigations using a Graphical User Interface (GUI) in a flexible manner. The relationship between data entry, storage and retrieval of technical survey information is shown in Figure 1, (using information gathered from an impact survey as an example).

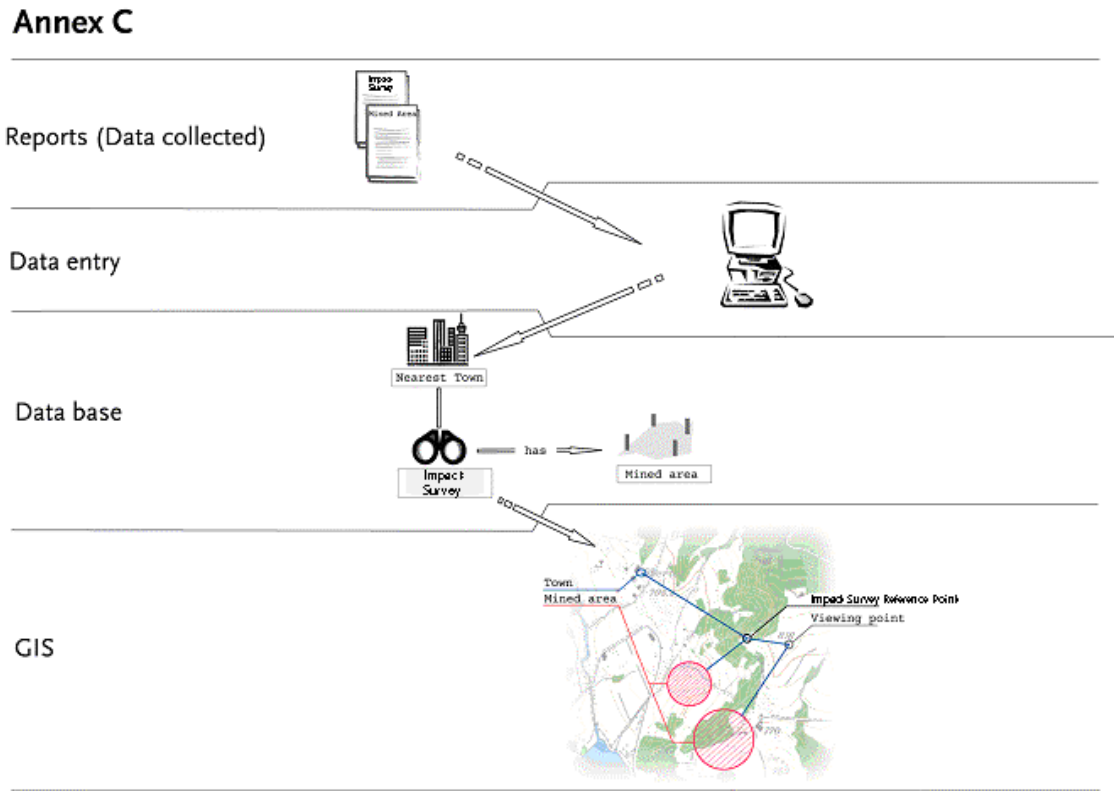

Figure 1: IMSMA FM - general mine action assessment data entry, storage and retrieval

Data entry. The normal means of entering information is via two forms in the FM: the Dangerous Area Report and the Mined Area Report (the Mined Area Report can be used when UXOs exist with mines, or when UXOs exist alone such as areas affected by cluster bomb strikes. The report formats defined in IMSMA may be used as provided, or they may be customised to meet local requirements.

a. A Dangerous Area Report allows the User to enter data on suspected but unconfirmed hazards and hazardous areas. Such details include: the general location and extent of the hazardous area (longitude, latitude, easting, northing, MGRS coordinates); description of a reference point; distance from and direction to the nearest town; the category and type of mines and UXO reported (if known), the estimated quantity of mines and UXO (if known), and details of minefield records (if they exist). The Report also allows other related information to be entered such as access and land use.

b. A Mined Area Report allows the User to enter additional information once the hazardous area has been confirmed following a site visit conducted as part of the general mine action assessment process. The Mined Area Report contains sufficient information to enable detailed planning for clearance to begin, although it may still be necessary to carry out a much more detailed Technical Survey of the site prior to clearance to confirm the perimeter of the contaminated area containing mines and/or UXO.

Additional information on the mine and UXO threat will come from Accident, Incident and Contact Reports.

As part of the general mine action assessment process it is also necessary to collect and record other general information such as the condition and potential of the local infrastructure, including logistic facilities, transportation, communications and medical facilities which could be used to support technical survey and/or clearance projects. This information can be entered using Country, Province and/or District Features data entry forms.

Data storage. Information is stored in tables within the IMSMA FM database. These tables are structured and named to reflect the category and function of information held, for example the Hazardous Areas Table or the Country Features Table.

Reporting and Analysis Tools. IMSMA contains predefined reports useful for summarising data collected during the general mine action assessment. IMSMA GIS functionality includes analysis tools which assist in developing mine clearance plans from the database.

IMAS 08.20

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Technical survey

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Warning

This document is current with effect from the date shown on the cover page. As the International Mine Action Standards (IMAS) are subject to regular review and revision, users should consult the IMAS project website in order to verify its status. (http://www.mineactionstandards.org/, or through the UNMAS website at http://www.mineaction.org)

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Contents

Foreword

In July 1996, international standards for humanitarian mine clearance programmes were proposed by working groups at a conference in Denmark. Criteria were prescribed for all aspects of mine clearance, standards were recommended and a new universal definition of 'clearance' was agreed. In late 1996 the principles proposed in Denmark were developed by a UN-led working group into *International Standards for Humanitarian Mine Clearance Operations*. A first edition of these standards was issued by the UN Mine Action Service (UNMAS) in March 1997.

This second edition reflects changes to operational procedures, practices and norms which have occurred over the past three years. The scope of these standards has been expanded to include the other components of mine action, in particular those of mine risk education and victim assistance.

The United Nations has a general responsibility for enabling and encouraging the effective management of mine action programmes, including the development and maintenance of standards. UNMAS is the office within the United Nations Secretariat responsible for the development and maintenance of international mine action standards (IMAS).

The work of preparing, reviewing and revising these standards is conducted by technical committees, with the support of international, governmental and non-governmental organisations. The latest version of each standard, together with information on the work of the technical committees, can be found at http://www.mineactionstandards.org/. IMAS will be reviewed at least every three years to reflect developing mine action norms and practices, and to incorporate changes to international regulations and requirements.

Introduction

Technical survey is the detailed technical and topographical investigation of known or suspected hazardous areas. Such areas will have been previously identified during the general mine action assessment. The primary aim of a technical survey is to collect sufficient information to enable the clearance requirement to be more accurately defined, including the area(s) to be cleared, the depth of clearance, local soil conditions, and the vegetation characteristics.

The information obtained from a technical survey should be summarised in a survey report, which may be used as the technical specification for the planning and management of a subsequent clearance task. The output of a technical survey may also include perimeter marking to reduce the risk of unintentional entry into the hazardous area, normally as part of a comprehensive mine risk education and education programme. If clearance does not immediately follow a technical survey, then survey markers should be left securely in place. Such markers will enable the hazardous area to be located accurately and safely at a later date.

The term 'technical survey' is not applied universally. Indeed, some national mine action authorities and demining organisations consider the detailed examination of known or suspected hazardous areas, and the related documentation and marking as defined in this standard, to be merely the first stage of an integrated survey-clearance operation. However it is described, technical survey is an important part of the clearance process, by providing the information needed for safe, effective and efficient clearance.

Technical survey

1 Scope

This standard establishes principles and provides guidance on the requirements of technical surveys, and details responsibilities and obligations of the agencies and organisations involved.

2 Normative references

A list of normative references is given in Annex A. Normative references are important documents to which reference is made in this standard and which form part of the provisions of this standard.

3 Terms and definitions

A list of terms and definitions used in this standard is given in Annex B. A complete glossary of all the terms and definitions used in the IMAS series of standards is given in IMAS 04.10.

In the IMAS series of standards, the words 'shall', 'should' and 'may' are used to indicate the intended degree of compliance. This use is consistent with the language used in ISO standards and guidelines.

a) 'shall' is used to indicate requirements, methods or specifications that are to be applied in order to conform to the standard.

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4 Technical survey – purpose and scope

Technical survey is the detailed technical and topographical investigation of known or suspected hazardous areas. Such areas will have been previously identified during the general mine action assessment. The primary aim of a technical survey is to collect sufficient information to enable the clearance requirement to be more accurately defined, including the area(s) to be cleared, the depth of clearance, local soil conditions, and the vegetation characteristics. This will enable subsequent clearance operations to be conducted in a safe, effective and efficient manner.

Sometimes it may be appropriate to conduct a technical survey when there is no immediate need to clear all the land. The objective in such circumstances is to accurately identify, record, mark and fence the outer edge of the hazardous area, and by doing so release some land for productive use. The process through which the initial area indicated as contaminated (during the general mine action assessment) is reduced to a smaller area, is known as 'area reduction'. Area reduction may involve some limited clearance, such as the opening of access routes and the destruction of mines and UXO which represent an immediate and unacceptable risk, but it will mainly be as a consequence of collecting more reliable information on the extent of the hazardous area. The remaining hazardous area(s) should normally be marked with permanent or temporary marking systems; see IMAS 08.40 for details on hazard marking.

Sometimes, the technical survey will represent just the first phase of a clearance project, and a detailed technical understanding of the mine and UXO threat will develop as clearance progresses. This will often be the case during the early stage of humanitarian interventions, such as the rapid survey and clearance of routes needed to deliver humanitarian aid or to assist the movement of refugees and internally displaced persons, during the initial phase of the general mine action assessment, or when some suspected areas have to be cleared for operational reasons.

The scope and extent of each technical survey depends on many factors, including the accuracy and completeness of existing information (such as information collected during the general mine action assessment), the local security situation, and the human and financial resources available for the survey. It will also depend on the form of the hazards and hazardous areas. For example, the technical survey of a classic minefield laid by an army using standard mine laying procedures would be quite different to the technical survey of a paddy field or well around which anti-personnel mines and booby traps have been laid in an irregular fashion for the harassment of the local population.

A technical survey should also review, and if necessary revise, the general planning information collected during the general mine action assessment. This will include details, such as the local security situation, routes, terrain, infrastructure and the availability of suitable medical facilities. Often it will also be appropriate to review the local socio-economic impact of the hazardous area(s) in order to confirm the need and urgency of the follow-on clearance operation(s).

There is still ongoing discussion among the mine action community about the validity of techniques used in technical surveys. Agencies conducting technical surveys should be able to demonstrate that the methodology employed in the technical survey is valid and capable of producing the results that the survey process is expected to produce.

5 Clearance requirements

IMAS 09.10 defines the requirements of mine and UXO 'clearance', and specifies the quality system (i.e. the organisation, procedures and responsibilities) necessary to determine that land has been cleared by a demining organisation in accordance with its contractual obligations.

The contractual arrangements shall specify the area to be cleared and the required depth of clearance. The clearance depth should be determined by a technical survey, or from some other reliable information which establishes the depth of the mine and UXO hazards, and an assessment of the intended land use.

An informed decision on the likely depth of mines and UXO will require an understanding of the minelaying tactics and weapon systems used, and an assessment of whether there has been any soil slippage or vertical movement of the mines within the soil. It may also involve the clearance of one or more sample areas.

The soil should be analysed to determine mineral and scrap metal contamination which will affect the choice of detectors. Tests of the soil's composition and mechanics should be made, to establish the potential use of mechanical equipment. Access and trafficability of routes leading to the site should also be examined especially where the use of heavy mechanical equipment is considered.

Land released as a result of technical survey shall be of the same confidence level as that would be achieved by clearance. This land should be recorded using a handover certificate similar to that at Annex D to IMAS 08.30 Post-clearance documentation.

6 Marking

6.1 Hazard marking

The marking of mine and UXO hazards is undertaken to provide a clear and unambiguous warning of danger to the local population, and where possible to install a physical barrier to reduce the risk of unintentional entry into hazardous areas.

Permanent marking systems should be used to indicate the outer edge of mine and UXO hazard areas which are not scheduled for immediate clearance. They should employ a combination of markers, signs and physical barriers. Temporary marking systems may be used to mark the perimeter of a mine and UXO hazard area in preparation for clearance operations.

The design of mine and UXO hazard marking systems should take account of local materials freely available in the contaminated region and the period for which the marking system will be in place. Guidance on permanent and temporary hazard marking systems is given in IMAS 08.40.

6.2 Survey marking

Technical survey involves the use and recording of physical survey markers and indicators to assist subsequent clearance operations.

(Note: additional physical markers and indicators are used during clearance, such as datum points, datum/base lines, start lines and clearance lanes. The forms of marking used during clearance are not included in this standard.)

6.2.1 Reference point

A reference point (referred to in IMSMA as a 'landmark') is a fixed point of reference some distance outside the hazardous area. It should be an easily recognisable and permanent feature (such as a cross-roads or the abutment of a bridge) which can be used to assist in navigating to one or more benchmarks. The co-ordinates of a reference point should be surveyed by GPS or by resection. Further guidance is given in Annex C. (Note: current commercial GPS accuracy is limited to +/- 15m.)

6.2.2 Benchmark

A benchmark is a fixed point of reference used to locate a marked and recorded hazard or hazardous area. It should normally be located a short distance outside the suspected hazardous area. A benchmark may not be necessary if the reference point is sufficiently close to the perimeter of the hazardous area. The co-ordinates of a reference point should be surveyed by GPS, or by resection. Further guidance is given in Annex C

6.2.3 Turning point

A turning point is a fixed point on the ground which indicates a change in direction of the perimeter of the hazardous area. It shall be clearly marked and recorded. Buried metal objects may be used to reinforce the marking of all turning points for permanent future reference. Further guidance is given in Annex C

6.2.4 Intermediate point

The distance between adjacent signs and markers on the perimeter of a hazardous area should not exceed 50m. Intermediate survey markers shall be used between turning points that are more than 50m apart. Intermediate survey markers shall be made of permanent or semi-permanent material, and should be buried or driven into the ground. Further guidance is given in Annex C.

7 Documentation

Information should be collected and recorded in a systematic manner. Whenever possible use should be made of standard and proven information management systems and GIS, such as IMSMA. Guidance on the use of IMSMA data collection sheets as part of the technical survey process is given in Annex D.

General location maps should be used to indicate the general area of the hazardous area, and in particular to mark the reference point (or landmark). Such information should be recorded electronically using GIS, or marked on a topographical map, a satellite image or on a trace. If GIS or topographical maps are not available, such information may be recorded on locally produced maps.

A sketch map of the hazardous area shall include sufficient detail on the location and identification of the survey markers (see Clause 6.2) and the hazard marking system. Other relevant information which will assist future clearance activities should be included.

The information recorded during the technical survey shall also form an important part of the documentation required for the handover to the organisation conducting clearance, and later for the final handover of the cleared land to the national mine action authorities. (See IMAS 08.30)

8 International treaties

Two international treaties place special obligations on the Governments of mine-affected countries (who are States Party to the treaties) regarding the survey and marking of mined areas.

Amended Protocol II (AP II) to the UN Conventional Weaponry Convention requires that '… all reasonable precautions should be taken to protect civilians from the impact of mines, booby-traps and other devices.'

Article 5.2 of the *Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-personnel Mines and on their Destruction* (commonly known as the Ottawa Convention or Mine Ban Treaty) requires each State Party to '… make every effort to identify all areas under its jurisdiction or control in which anti-personnel mines are known or suspected to be emplaced and (to) ensure as soon as possible that all anti-personnel mines in mined areas under its jurisdiction or control are perimeter-marked, monitored and protected by fencing or other means, to ensure the effective exclusion of civilians, until all anti-personnel mines contained therein have been destroyed.'

Thus both AP II and the Ottawa Treaty imply an obligation on the Governments of mine-affected countries, who are also States Party to one or both of the agreements, to ensure that all mined areas under their jurisdiction and control are accurately surveyed, and then perimeter-marked by fencing or other means. Such marking and fencing will normally form part of a technical survey.

9 Responsibilities and obligations

9.1 National mine action authority

The national mine action authority shall:

a) accredit organisations as fit to undertake technical surveys;

b) prepare and publish standards and guidelines for quality assurance and quality control to be applied to technical survey contracts and agreements;

c) prepare and publish standards for the design and construction of hazard marking systems to be used in national demining projects, and provide guidance to regional and local authorities on the retention and maintenance of minefield marking systems;

d) prepare and publish standards for survey marking;

e) prepare and publish standards for the documentation of technical surveys; and

f) maintain documentation, and make available documentation to authorities, organisations and the local population as required.

9.2 Survey organisation

The organisation undertaking the survey shall:

a) gain (from the national mine action authority) accreditation and the licenses needed to conduct technical surveys;

b) apply the national standards for technical survey, including marking. In the absence of national standards, the survey organisation shall apply the IMAS standards, or such standards as are specified in their contract or agreement;

c) if possible, conduct a formal handover of the surveyed land to the organisation conducting clearance; and

d) maintain and make available documentation as specified by the national mine action authority.

In the absence of a national mine action authority or authorities, the survey organisation should assume additional responsibilities. These include, but are not restricted to:

a) agree common marking standards with other survey organisations operating in the same general area; and

b) assist the host nation, during the establishment of a national mine action authority, in framing national standards for technical surveys, including quality assurance and quality control.

Annex A
(Informative)
Normative references

The following normative documents contain provisions, which, through reference in this text, constitute provisions of this part of the standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of the standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid ISO or EN:

a) IMAS 08.10. General mine action assessment;

b) IMAS 08.30. Post-clearance documentation;

c) IMAS 08.40. Marking - mine and UXO hazards; and

d) IMAS 09.10. Clearance requirements.

The latest version/edition of these references should be used. GICHD hold copies of all references used in this standard. A register of the latest version/edition of the IMAS standards, guides and references is maintained by GICHD, and can be read on the IMAS website (http://www.mineactionstandards.org/). National mine action authorities, employers and other interested bodies and organisations should obtain copies before commencing mine action programmes.

Annex B
(Informative)
Terms and Definitions

B.1.1
area reduction
the process through which the initial area indicated as contaminated (during the general mine action assessment) is reduced to a smaller area.

Note: Area reduction may involve some limited clearance, such as the opening of access routes and the destruction of mines and UXO which represent an immediate and unacceptable risk, but it will mainly be as a consequence of collecting more reliable information on the extent of the hazardous area. Usually it will be appropriate to mark the remaining hazardous area(s) with permanent or temporary marking systems.

B.1.2
benchmark
a fixed point of reference used to locate a marked and recorded hazard or hazardous area. It should normally be located a short distance outside the hazardous area.

Note: A benchmark may not be necessary if the reference point is sufficiently close to the perimeter of the hazardous area.

B.1.3
hazard (ous) area
contaminated area
a generic term for an area not in productive use due to the perceived or actual presence of mines UXO or other explosive devices.

B.1.4
IMSMA
The Information Management System for Mine Action (IMSMA).

Note: This is the United Nation's preferred information system for the management of critical data in UN-supported field programmes and at the UN headquarters in New York. IMSMA consists, essentially, of two modules: the Field Module (FM) and Global Module (GM). The FM provides for data collection, information analysis and project management. It is used by the staffs of mine action centres at national and regional level, and by the implementors of mine action projects - such as demining organisations. The GM refines and collates data from IMSMA FMs (and other field-based information systems) and provides the UN and others with accurate, aggregated information for the strategic management of mine action.

B.1.5
intermediate point
survey markers used between turning points that are more than 50m apart.

B.1.6
reference point
landmark
a fixed point of reference some distance outside the hazard(ous) area. It should be an easily recognised feature (such as a cross-roads or a bridge) which can be used to assist in navigating to one or more benchmarks.

Note: Internationally these are often also referred to as Geodetic Points when the refer to a pre-surveyed location such as a trig point.

B.1.7
survey marker
a durable and long lasting marker used to assist in the management of marked and cleared land demining operations.

B.1.8
turning point
a fixed point on the ground which indicates a change in direction of the perimeter of the hazardous area.

Annex C
(Informative)
Survey marking

1 General principles

Technical survey involves the use and recording of physical survey markers and indicators to assist subsequent clearance operations. As the survey and clearance may be conducted by different organisations it is essential that standard survey marking is used in each country. National mine action authorities shall develop and publish such standards. This annex provides an example of the type and quality of marking required. In the absence of a national mine action authority or authorities, the survey organisation should adopt the following marking scheme.

Signs made of combustible, usable or attractive material may be removed by the local population, especially during conditions of emergency interventions, when the country will be starved of resources and materials. Signs will then have to be replaced by easily identifiable markings (such as painted cairns of stones or paint marks on walls or trees). Above all, such marks must be clear, and their locations documented as accurately as possible on hazard area maps. It also makes the physical handover of the ground from the technical survey to the demining organisation more important. Where such handovers cannot be made, it is the responsibility of the technical survey organisation, operating in conjunction with the local population, to ensure that an enduring marking system is devised.

2 Reference points

A reference point (referred to in IMSMA as a 'landmark') is a fixed point of reference some distance outside the hazardous area. It should be an easily recognised feature (such as a cross-roads or the abutment of a bridge) which can be used to assist in navigating to one or more benchmarks. The co-ordinates of a reference point should be surveyed by resection or GPS. (Note: current commercial GPS accuracy is limited to +/-15m.)

Reference points shall be:

a) clearly visible from 30 m in normal daylight conditions from the normal direction of approach.

b) marked with a sign, which clearly distinguishes the sign from other marked area signs. The sign shall include a unique identification number, and show the distance and bearing to the benchmark. Details should be stamped, engraved, embossed, or marked in some other permanent way. The sign should be applied to a surface or attached to a post at approximately 1.25 m above ground level.

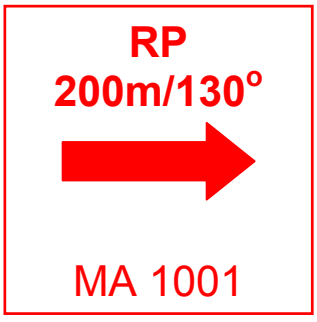

Figure 1: Reference point marker

Note: Figure 1 shows a sign indicating a reference point for Minefield Number 1001. It indicates that the benchmark for Minefield 1001 is located 200 m from this point on a magnetic compass bearing of 130°

3 Benchmarks

Benchmarks are fixed points of reference used to locate a marked and recorded hazard or hazardous area. A benchmark should normally be located a short distance outside the hazardous area.

Benchmarks shall be:

a) be surveyed by resection or GPS;

b) clearly visible from 30 m in normal daylight conditions from the normal direction of approach; and

c) marked with a sign, which clearly distinguishes the sign from other marked area signs. The sign shall include a unique identification number. Details should be stamped, engraved, embossed, or marked in some other permanent way. The sign should be applied to a surface or attached to a post at approximately 1.25 m above ground level.

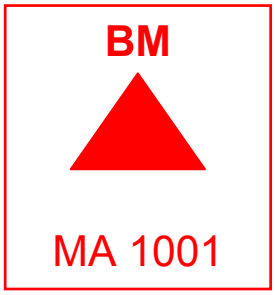

Figure 2: Benchmark sign

Note: Figure 2 shows a sign indicating a benchmark sign for Minefield Number 1001.

4 Turning points

Turning points are fixed points on the ground which indicates a change in direction of the perimeter of the hazardous area.

Turning points shall be:

a) be surveyed by resection or GPS, and with the coordinates formally recorded;

b) clearly visible from 30 m in normal daylight conditions from the normal direction of approach;

c) marked by three survey markers: one at the change of direction, and one each side on the perimeter. The markers should be spaced 1.0m apart, clearly marked and recorded. Buried metal objects should also be used to mark all turning points for permanent future reference.

d) marked with a sign, which clearly distinguishes the sign from other marked area signs. Details should be stamped, engraved, embossed, or marked in some other permanent way. The sign should be applied to a surface or attached to a post at approximately 1.25m above ground level.

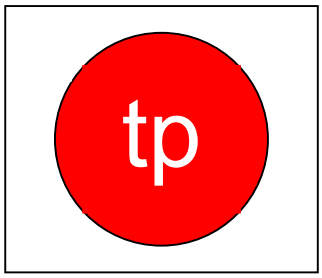

Figure 3: Example of a turning point sign

5 Intermediate points

The distance between adjacent signs and markers on the perimeter of a hazardous area should not exceed 50m. Intermediate survey markers shall be used between turning points that are more than 50m apart. Intermediate survey markers shall be made of permanent or semi-permanent material, and should be buried or driven into the ground.

The general position of intermediate points should be formally recorded, but accurate coordinates are not required.

Intermediate points need not be marked with a sign.

Annex D
(Informative)
Guidance on the use of IMSMA for technical surveys

IMSMA. The Information Management System for Mine Action (IMSMA) is the United Nation's preferred information system for the management of critical data in UN-supported field programmes and at the UN headquarters in New York. IMSMA consists, essentially, of two modules: the Field Module (FM) and Global Module (GM). The FM provides for data collection, information analysis and project management. It is used by the staffs of mine action centres at national and regional level, and by the implementors of mine action projects - such as demining organisations. The GM refines and collates data from IMSMA FMs (and other field-based information systems) and provides the UN and others with accurate, aggregated information for the strategic management of mine action.

Technical survey. Technical survey is the detailed technical and topographical investigation of known or suspected hazardous areas. Such areas may have been previously identified during the general mine action assessment (formerly called Level 1 surveys) or otherwise reported. IMSMA enables the User to enter, store and retrieve the information from such investigations using a Graphical User Interface (GUI) in a flexible manner. The relationship between data entry, storage and retrieval of technical survey information is shown in Figure 1.

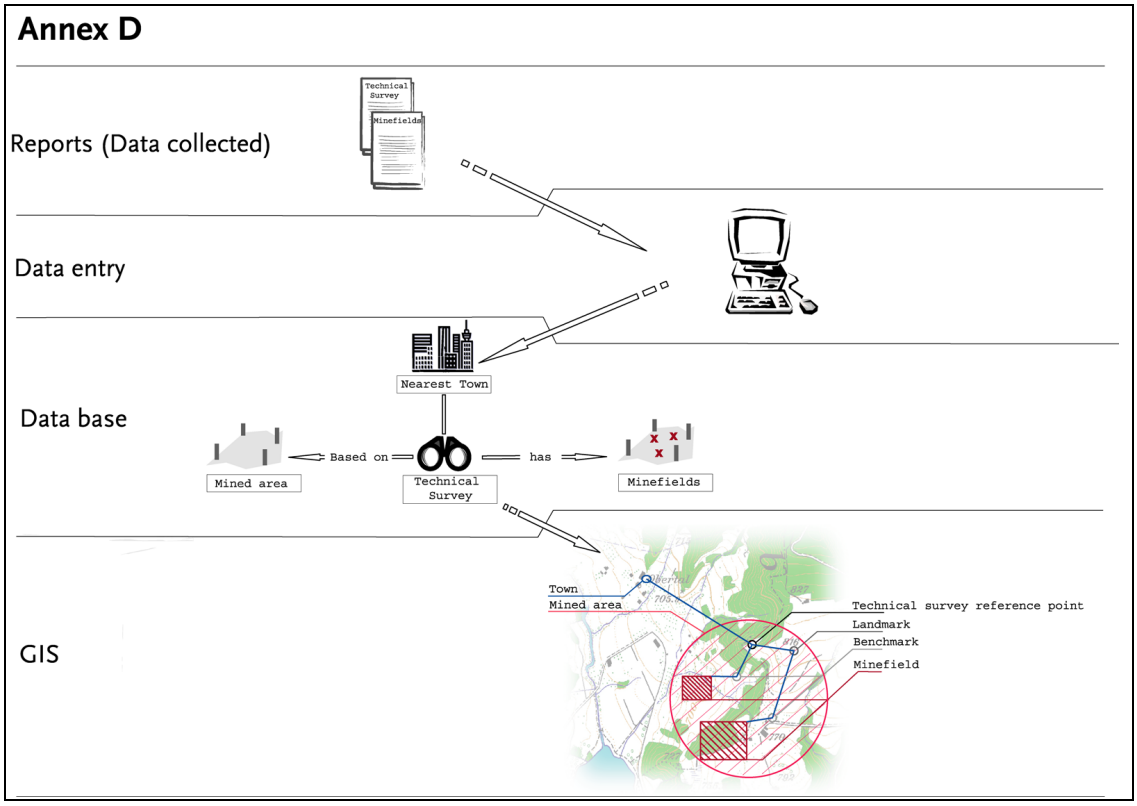

Figure 1: IMSMA FM - technical survey data entry, storage and retrieval

Data entry. The normal means of entering technical survey information is via two forms in the FM: the Minefield Report and the Technical Survey Report. The report formats defined in IMSMA may be used as provided, or they may be customised to meet local requirements.

a. A Minefield Report allows the User to enter data on the hazards (type, estimated quantity, depth of burial of mines/UXO and hazard marking systems emplaced), the location of physical survey markers (reference point and benchmarks), details on the mined areas perimeter (turning and intermediate points) and terrain information (soil type, ground profile, slope, drainage, vegetation cover and contamination/obstacles). The Report also allows other related information to be entered such as access, land use and the location of local medical facilities.

b. A Technical Survey Report allows the User to enter additional information when two or more mined areas are grouped closely together and are treated as a single task or project.

Technical surveys may refer to areas previously recorded in IMSMA, perhaps as part of the general mine action assessment or included in a Dangerous Area Report or Mined Area Data Sheet. In such cases, it is important to use the same reference (i.e. mine area number). The Navigator and the IMSMA GIS functionality assist the user in identifying relevant and related reports and data sheets.

Data storage. Information is stored in Technical Survey tables within the IMSMA FM database. Additional relevant local information may be stored in other tables within the IMSMA FM database, for example in Contact, Location or Country Features tables.

Data retrieval. Data can be retrieved from the Technical Survey Report and associated Minefield Reports. Progress Reports can also be used to provide information on work done, and in progress, for each of the minefields referred to in the Technical Survey. This includes, for example, areas cleared (as part of an area/boundary reduction process), devices cleared or marked during survey, and other details of the survey process such as resources expended.

Reporting and Analysis Tools. IMSMA contains predefined reports useful for summarising data collected during the Technical Survey. IMSMA GIS functionality includes analysis tools which assist in developing mine clearance plans from the database.

IMAS 08.30

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Post-clearance documentation

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Warning

This document is current with effect from the date shown on the cover page. As the International Mine Action Standards (IMAS) are subject to regular review and revision, users should consult the IMAS project website in order to verify its status. (http://www.mineactionstandards.org/, or through the UNMAS website at http://www.mineaction.org)

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Contents

Foreword

In July 1996, international standards for humanitarian mine clearance programmes were proposed by working groups at a conference in Denmark. Criteria were prescribed for all aspects of mine clearance, standards were recommended and a new universal definition of 'clearance' was agreed. In late 1996 the principles proposed in Denmark were developed by a UN-led working group into *International Standards for Humanitarian Mine Clearance Operations*. A first edition of these standards was issued by the UN Mine Action Service (UNMAS) in March 1997.

This second edition reflects changes to operational procedures, practices and norms that have occurred over the past three years. The scope of these standards has been expanded to include the other components of mine action, in particular those of mine risk education and victim assistance.

The United Nations has a general responsibility for enabling and encouraging the effective management of mine action programmes, including the development and maintenance of standards. UNMAS is the office within the United Nations Secretariat responsible for the development and maintenance of international mine action standards (IMAS).

The work of preparing, reviewing and revising these standards is conducted by technical committees, with the support of international, governmental and non-governmental organisations. The latest version of each standard, together with information on the work of the technical committees, can be found at http://www.mineactionstandards.org/. IMAS will be reviewed at least every three years to reflect developing mine action norms and practices, and to incorporate changes to international regulations and requirements.

Introduction

Once land has been cleared of mines and UXO there is usually an urgent need to make it available for productive use without delay. In some cases the local population will follow-up and occupy land immediately following clearance in order to confirm ownership by re-establishing historic land rights. And at the end of a project, the demining organisation will be keen to re-deploy its demining teams to new sites requiring urgent clearance.

Despite the pressure to move on, there are some important issues which must be addressed and tasks which must be completed before the land can be considered formally 'cleared' and available for use. In particular, all post-clearance inspections should be completed and any corrective action carried out; permanent survey markers including turning points and intermediate points should be emplaced and accurately recorded for future reference; and all necessary information such as monitoring and inspection reports should be collated and made available for the formal handover. The demining organisation, or its nominated community liaison representative shall ensure that the mine affected community is fully cognisant of all demining activities in the area and the implications for the community.

The formal handover of cleared land is most important. The procedure and documentation required for the handover aim to clarify the ownership of any residual risk, and to determine the legal responsibilities and accountability of the donor, the national mine action authority and demining organisation(s) following handover.

This standard provides guidance on the procedural requirements for the handover of cleared land.

Post-clearance documentation

1 Scope

This standard provides guidance on the procedural requirements for the handover of cleared land, and details responsibilities and obligations.

2 References

A list of normative references is given in Annex A. Normative references are important documents to which reference is made in this standard and which form part of the provisions of this standard.

3 Terms and definitions

A list of terms and definitions used in this standard is given in Annex B. A complete glossary of all the terms and definitions used in the IMAS series of standards is given in IMAS 04.10.

In the IMAS series of standards, the words 'shall', 'should' and 'may' are used to indicate the intended degree of compliance. This use is consistent with the language used in ISO standards and guidelines.

a) 'shall' is used to indicate requirements, methods or specifications that are to be applied in order to conform to the standard.

b) 'should' is used to indicate the preferred requirements, methods or specifications.

c) 'may' is used to indicate a possible method or course of action.

The term 'national mine action authority/authorities' refers to the government department(s), organisation(s) or institution(s) in each mine-affected country charged with the regulation, management and co-ordination of mine action. In most cases the national mine action centre (MAC) or its equivalent will act as, or on behalf of, the 'national mine action authority'.

4 Requirements

4.1 Clearance confirmation

The documentation which is made available for handover shall provide sufficient evidence that the clearance requirement has been met. Clearance is achieved and demonstrated in two stages. Stage 1 involves the monitoring of the demining organisation's management systems and operational procedures before and during the clearance process. Stage 2 involves the inspection of cleared land by sampling. IMAS 07.40 provides guidance on the monitoring requirements and IMAS 09.20 provides guidance on the procedures to be adopted for post-clearance inspections.

Reports produced during the monitoring and post-clearance inspections, together with follow-up inspections to confirm that any corrective action has been successfully completed, should be included in the handover documentation.

4.2 Survey marking

During a technical survey, the perimeter of the hazardous area(s) should be indicated with survey markers, as defined in IMAS 08.20.

Further information obtained during clearance should indicate the actual location of each mine and UXO. It may then be necessary to re-define the perimeter of the area, and to re-position the permanent survey markers to show the actual area cleared. Buried metal objects should be used as permanent markers.

The new positions should be accurately surveyed, and the coordinates of the turning points and intermediate points should be recorded for future reference. See Clause 4.4 below.

4.3 Hazard marking

Land which has not been cleared prior to handover for whatever reason, or cannot be confirmed as cleared, should be clearly marked with permanent hazard marking systems. Ideally, such areas should use physical barriers such as robust fencing to reduce the risk of unintentional entry into the remaining hazardous area(s).

IMAS 08.40 provides guidance on hazard marking.

4.4 Residual risk and liability

This is a complex legal issue that should be explored with the national mine action authority during the contract negotiation stage. In general, for humanitarian operations no residual risk should lay with the demining organisation after the national mine action authority has formally accepted the cleared land. The handover of the cleared land shall be the mitigation of liability point for the demining organisation.

For contract work in support of privately financed commercial development the contract may insist that some degree of residual risk lies with the demining organisation; it is then up to the demining organisation as to whether they wish to accept such a contract.

4.5 Documentation

4.5.1 Completion report and handover certificate

Information should be collected and recorded in a systematic manner during the clearance operation. Whenever possible use should be made of standard and proven information management systems and GIS, such as IMSMA. Guidance on the use of IMSMA for compiling a completion report and handover certificate is given in Annex C.

The completion report should include at least the following information:

a) hazard area and task identification numbers;

b) clearance requirements – specified area and specified depth;

c) a copy of the technical survey report (if available);

d) details of the clearance organisation, including references to its accreditation and licenses;

e) a summary of the procedures and equipment used to clear the area;

f) quality assurance, with details on the body which conducted the monitoring, the methods used and reports provided;

g) post-clearance inspection reports, with details on the body which conducted the inspections, the methods used and reports provided;

h) details of the cleared area(s): coordinates of the turning points and intermediate points, and a list of the mines and UXO located and destroyed during clearance;

i) details of reduced and cancelled area(s);

j) details of any incidents and accidents which occurred during clearance;

k) a formal recognition from the mine affected community of community involvement and acknowledgement of the final status of the land. (See IMAS 07.41 Monitoring of MRRE organisations);

Note: The demining organisation should brief the local community and the proposed beneficiary of the cleared land on the task when it is complete and has been formally handed over to the national mine action authority. Such a briefing should include a subjective confidence demonstration and an explanation of the residual risk.

l) a comparison with known minefield records; and

m) a formal declaration that indicates that the land has been cleared over the specified area to the specified depth. (Legal advice should be sought as to the detailed wording of this declaration in each mine-affected country, however an example that is currently used is at Annex D).

The national mine action authority should be custodian of all completion reports, handover certificates and supporting information.

4.5.2 Post project review

Wherever possible, demining organisations should conduct a formal post project review (PPR), (on the contract, not individual tasks), to identify lessons-learned during the planning, preparation and clearance phases of the operation. The PPR should include a report on the suitability of the equipment, procedures, training and support. Issues of concern should be identified and prioritised, and solutions proposed. The requirement for PPRs should be included in clearance contracts by donors and national authorities. PPRs should be distributed to national mine action authorities, to the United Nations (UNMAS, UNDP and UNOPS), and to donors or sponsors. Where PPRs highlight shortcomings in established equipment or procedures, particularly issues involving safety, they should be more widely distributed.

5 Responsibilities and obligations

5.1 National mine action authority

The national mine action authority shall:

a) prepare and publish standards and provide guidance for the documentation required for handover;

b) following handover, maintain documentation and act as custodian of all completion reports, handover certificates and supporting information; and

c) make available documentation to authorities, organisations and the local population as required. Post-clearance documentation should be held in perpetuity in a national records archive.

5.2 Demining organisation

The demining organisation shall apply the national standards for the handover of cleared land, including the collection and collation of the information detailed in Clause 4.4 above.

In the absence of a national mine action authority or authorities, the demining organisations should assist the host nation, during the establishment of a national mine action authority, in framing national standards for the handover of cleared land.

Annex A
(Normative)
Normative references

The following normative documents contain provisions, which, through reference in this text, constitute provisions of this part of the standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of the standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid ISO or EN:

a) IMAS 07.40 Monitoring of demining organisations;

b) IMAS 07.41 Monitoring of MRRE organisation;.

c) IMAS 09.10 Clearance requirements; and

d) IMAS 09.20 Post-clearance inspections and sampling.

The latest version/edition of these references should be used. GICHD hold copies of all references used in this standard. A register of the latest version/edition of the IMAS standards, guides and references is maintained by GICHD, and can be read on the IMAS website (http://www.mineactionstandards.org/). National mine action authorities, employers and other interested bodies and organisations should obtain copies before commencing mine action programmes.

Annex B
(Normative)
Terms and Definitions

B.1.1
area reduction
the process through which an area indicated as contaminated (during a general survey) is reduced to a smaller area.

Note: Area reduction may involve some limited clearance, such as the opening of access routes and the destruction of mines and UXO which represent an immediate and unacceptable risk, but it will mainly be as a consequence of collecting more reliable information on the extent of the hazardous area. Usually it will be appropriate to mark the remaining hazardous area(s) with permanent or temporary marking systems.

B.1.2
boundary lane
a cleared lane around the perimeter of a hazard area.

B.1.3
cancelled area
an area previously recorded as a hazard(ous) area which subsequently is considered, as a result of actions other than clearance, not to represent a risk from mines and UXO.

Note: This change in status will be the result of more accurate and reliable information, and will normally only be authorised by the national mine action authorities, in accordance with national policy. The documentation of all cancelled areas shall be retained together with a detailed explanation of the reasons for the change in status.

B.1.4
cleared area
land shall be accepted as 'cleared' when the demining organisation has ensured the removal and/or destruction of all mine and UXO hazards from the specified area to the specified depth in accordance with its contractual obligations.

Note: IMAS 09.10 specifies the quality system (i.e. the organisation, procedures and responsibilities) necessary to determine that land has been cleared by the demining organisation in accordance with its contractual obligations.

Note: Cleared areas may include land cleared during the technical survey process, including boundary lanes and cleared lanes. Areas cleared for worksite administrative purposes, such as car parks, storage locations, and first aid posts need not be officially documented as cleared, unless national procedures so require.

B.1.5
cleared lane
safety lane
the generic term for any lane, other than a boundary lane, cleared by a survey or clearance team to the international standard for cleared land. This may include access lanes outside the hazard(ous) area or cross/verification lanes inside a hazard(ous) area.

B.1.6
hazard (ous) area
contaminated area
a generic term given to an area not in productive use due to the actual or perceived presence of mines, UXO or other explosive devices.

B.1.7
handover
the process by which the beneficiary (usually the national mine action authority) accepts responsibility for the cleared area. The term 'alienation' is sometimes used to describe a change of ownership of the land which accompanies the handover of a cleared area.

B.1.8
handover certificate
documentation used to record the handover of cleared land.

B.1.9
intermediate point
survey markers used between turning points that are more than 50m apart. Intermediate survey markers shall be made of permanent or semi-permanent material, and should be buried or driven into the ground.

B.1.10
monitoring
in the context of humanitarian demining, the term refers to ….. the authorised observation by qualified personnel of sites, activities or processes without taking responsibility for that being observed . This is usually carried out to check conformity with undertakings, procedures or standard practice and often includes recording and reporting elements.

*in the context of mine risk education, the term refers to …*the process of measuring or tracking what is happening. This includes:

a) measuring progress in relation to an implementation plan for an intervention – programmes/projects/activities, strategies, policies and specific objectives.

b) measuring change in a condition or set of conditions or lack thereof (e.g., changes in the situation of children and women or changes in the broader country context).

c) *definition from UNICEF Policy and Programming Manual.*

B.1.11
quality assurance (QA)
all the planned and systematic activities implemented within the quality system, and demonstrated as needed, to provide adequate confidence that an entity (i.e. that which can be individually described and considered) will fulfil requirements for quality. (ISO 8402 definition)

Note: The purpose of quality assurance in humanitarian demining is to confirm that management practices and operational procedures for demining are appropriate, and will achieve the stated requirement in a safe, effective and efficient manner. Internal quality assurance will be conducted by demining organisations themselves, but external inspections by an external monitoring body should also be conducted. Monitoring should involve structured discussions with management and deminers, and formal inspections of SOPs, reports and records.

B.1.12
reduced area
see **area reduction.**

B.1.13
residual risk
in the context of humanitarian demining, the term refers to ….. the risk remaining following the application of all reasonable efforts to remove and/or destroy all mine or UXO hazards from a specified area to a specified depth. [modified from ISO Guide 51:1999]

B.1.14
task identification number (ID)
a unique number used to designate a hazardous area. Task identification numbers shall be allocated by the national mine action authority.

B.1.15
tolerable risk
risk which is accepted in a given context based on current values of society [ISO Guide 51:1999(E)]

B.1.16
turning point
a fixed point on the ground which indicates a change in direction of the perimeter of the hazardous area. It shall be clearly marked and recorded. Buried metal objects should be used to mark all turning points for permanent future reference.

B.1.17
usable area
safe area
areas considered to have no risk or tolerable risk from mines and UXO.

Annex C
(Informative)
Guidance on the use of IMSMA for post-clearance documentation

IMSMA. The Information Management System for Mine Action (IMSMA) is the United Nation's preferred information system for the management of critical data in UN-supported field programmes and at the UN headquarters in New York. IMSMA consists, essentially, of two modules: the Field Module (FM) and Global Module (GM). The FM provides for data collection, information analysis and project management. It is used by the staffs of mine action centres at national and regional level, and by the implementors of mine action projects - such as demining organisations. The GM refines and collates data from IMSMA FMs (and other field-based information systems) and provides the UN and others with accurate, aggregated information for the strategic management of mine action.

Clearance activities. Clearance activities can be documented in the IMSMA FM in a variety of ways. Progress reports referenced to minefields can be used to record areas cleared or devices removed that are not part of a formal clearance task. Clearance reports can be entered, again referenced to minefields. These would typically be used to record a formal clearance task. Progress reports referenced to the clearance task can be entered on a periodic basis. Post Clearance Documentation Reports are provided to meet the requirement to document the completion of a clearance activity – these reports may be referenced to a Dangerous Area, Clearance, Impact Assessment, or Minefield record. The Task tool can be used to assist the task manager in organizing the various FM reports that are applicable to a clearance.

Clearance confirmation. Progress reports associated to FM Clearances are an important element of the documentation process which help to establish that effective procedures were in place during Stage 1 of the clearance confirmation.

Survey Marking. The final perimeter of the cleared area is stored in the FM Post Clearance Documentation Report.

Hazard Marking. Uncleared areas can be documented in Progress reports and/or in Completion reports.

Documentation. All reports entered into the IMSMA database that relate to a given task should be included in the final clearance documentation. The FM Task tool is a convenient means to select the various FM reports that are relevant to a clearance task. The Task tool allows the manager to store information regarding a task that has been assigned to an implementing agency, and organize all of the relevant IMSMA reports.

Annex D
(Informative)
Example handover certificate and formal declaration

<table>
<tr><th colspan="3">LOCATION</th></tr>
<tr><td>1. Map name:</td><td></td><td rowspan="7">8. Location of Cleared Area. (Description and GRID / UTM). (Include map and diagram of cleared area)</td></tr>
<tr><td>2. Edition:</td><td></td></tr>
<tr><td>3. Sheet Number:</td><td></td></tr>
<tr><td>4. Scale:</td><td></td></tr>
<tr><td>5. Series:</td><td></td></tr>
<tr><td>6. Local name:</td><td></td></tr>
<tr><td>7. Clearance depth:</td><td></td></tr>
<tr><th colspan="3">DETAILS OF CLEARANCE OPERATIONS</th></tr>
<tr><td colspan="2">9. Number and Type of Mine / UXO Cleared:</td><td>10. Final Disposal Method of Recovered Mines / UXO:</td></tr>
<tr><td colspan="2">11. Methods and Technology Used:</td><td>12. Is Area Metal Free?</td></tr>
<tr><td colspan="3">12. Quality Assurance Methodology:</td></tr>
<tr><td colspan="2">13. Minefield Serial Number:</td><td>14. Date of completion and hand over.</td></tr>
<tr><th colspan="2">HANDED OVER ON BEHALF OF DEMINING ORGANISATION</th><th>ACCEPTANCE BY NATIONAL MINE ACTION AUTHORITY</th></tr>
<tr><td colspan="2">15. Representative name and position.</td><td>16. National Mine Action Authority Representative name and position.</td></tr>
<tr><th colspan="3">DECLARATION BY SENIOR REPRESENTATIVE OF THE DEMINING ORGANISATION</th></tr>
<tr><td colspan="2">I certify that to the best of my knowledge and belief the area specified in this Completion Report has been cleared of all mine and UXO hazards to the depth specified in this Completion Report.</td><td>I certify that the area specified in this Completion Report has been independently assessed to be clear, to a confidence level of ___ %[1], of all mine and UXO hazards to the depth specified in this Completion Report.</td></tr>
<tr><td colspan="2">17. Signature of Demining Organisation Representative.</td><td>18. National Mine Action Authority Stamp.</td></tr>
<tr><th colspan="3">ACCEPTANCE BY NATIONAL MINE ACTION AUTHORITY</th></tr>
<tr><td colspan="2">I …….. accept responsibility of this area on behalf of the people of …….. I understand that the specified area has been cleared of mines and munitions to the depth specified in this Completion Certificate. I have also been briefed as to any potential residual risk.</td><td>19. Signature of the National Mine Action Authority Representative.</td></tr>
</table>

[1] This Confidence Level should be determined from IMAS 09.20.

Appendix A4

Summary Tables for Aluoi District Aerial Bombing Data

Table A4.1 Summary of US air combat missions flown over Aluoi District, 1965 to 1973, from Air Combat Database (source: US Military Archives).

A. Organized by category of ordnance

Category	Year									Total
	1965	1966	1967	1968	1969	1970	1971	1972	1973	
Ammunition	6	112	169	295	258	243	244	383	1	**1,711**
Chemical	-	-	-	49	10	11	4	4	-	**78**
Cluster bomb	-	113	72	129	94	153	65	454	16	**1,096**
Flare	-	2	1	4	9	1	1	-	-	**18**
General purpose	25	308	2,242	2,805	2,666	2,515	2,211	2,563	127	**15,462**
Incendiary	1	73	97	231	387	293	184	18	-	**1,284**
Mine	-	-	-	5	1	3	1	67	2	**79**
Missile	-	-	-	3	3	36	-	4	-	**46**
Other	-	2	3	2	10	24	24	66	-	**131**
Rocket	9	29	199	231	128	71	29	9	-	**705**
Total Missions	**41**	**640**	**2,783**	**3,754**	**3,566**	**3,350**	**2,763**	**3,568**	**146**	**20,611**

B. Organized by aircraft type

Aircraft Type	Year									Total
	1965	1966	1967	1968	1969	1970	1971	1972	1973	
A-1 (E/G/H/J)	11	111	58	63	49	46	4	12	-	**354**
A-4 (C/E/F)	54	315	1,808	1,512	1,993	787	477	405	-	**7,351**
A-6 (A/E)	-	2	460	386	216	216	123	210	17	**1,630**
A-7 (A/B/E)	-	-	-	11	210	359	267	672	54	**1,573**
A-37 (A/B)	-	-	-	26	-	442	932	437	-	**1,837**
AC-119 (G)	-	-	-	-	20	48	55	108	-	**231**
AC-130 (A)	-	-	-	-	2	25	8	205	-	**240**
B-52 (D)	-	-	-	-	114	198	316	1,845	30	**2,503**
B-57 (B)	4	348	44	2	2	132	352	-	-	**884**
F-4 (B/C/D/E/J/&)	66	514	1,310	2,172	3,031	3,004	1,791	3,908	191	**15,987**
F-8 (E/J)	-	82	632	306	2	-	-	68	10	**1,100**
F-100 (C/D/F)	-	3	134	1,855	379	901	477	-	-	**3,749**
TA-4 (F)	-	-	72	160	9	4	35	-	-	**280**
Other/Unknown	-	9	33	5	445	44	-	3	-	**539**
Total Aircraft	**135**	**1,384**	**4,551**	**6,498**	**6,472**	**6,206**	**4,837**	**7,873**	**302**	**38,258**

Table A4.2 Summary of ordnance loads, US air combat missions, Aluoi District, 1965 to 1973 (source: US Military Archives).

A. Number of pieces of ordnance

Category	Year									Total
	1965	1966	1967	1968	1969	1970	1971	1972	1973	
Ammunition	622	2,273	892	1,871	4,730	4,455	4,376	24,817	2	**44,038**
Chemical	-	-	-	99	18	44	16	16	-	**193**
Cluster bomb	-	651	214	250	205	946	298	2,624	62	**5,250**
Flare	-	9	37	112	161	3	4	-	-	**326**
General purpose	342	1,621	16,117	16,527	26,944	36,967	34,781	87,359	2,543	**223,201**
Incendiary	2	400	405	477	920	1,779	1,156	102	-	**5,241**
Mine	-	-	-	45	5	42	60	877	36	**1,065**
Missile	-	-	-	5	6	128	-	608	-	**747**
Other	-	20	12	4	61	93	74	308	-	**572**
Rocket	513	1,332	5,302	7,512	4,022	498	337	1,941	-	**21,457**
Total Pieces	**1,479**	**6,307**	**22,979**	**26,902**	**37,072**	**44,955**	**41,102**	**118,652**	**2,643**	**302,091**

B. Total weight of ordnance (lbs.)

Category	Year									Total
	1965	1966	1967	1968	1969	1970	1971	1972	1973	
Ammunition	342	4,980	9,157	15,038	12,709	380,430	1,520,066	1,370,594	1,140	**3,314,456**
Chemical	-	-	-	17,395	3,550	85,775	56,000	56,000	-	**218,720**
Cluster bomb	-	42,125	48,740	125,252	72,963	3,010,407	2,206,496	15,965,032	394,846	**21,865,861**
Flare	-	50	25	100	225	25	-	-	-	**425**
General purpose	10,407	156,941	1,510,872	1,848,807	1,601,490	47,400,582	144,821,508	347,572,168	10,573,862	**555,496,637**
Incendiary	912	45,593	61,955	155,061	239,690	5,841,427	7,107,756	604,096	-	**14,056,490**
Mine	-	-	-	3,124	531	117,715	250,624	3,269,244	107,256	**3,748,494**
Missile	-	-	-	4,880	3,513	933,183	-	5,416,496	-	**6,358,072**
Other	-	-	2,250	644	360	2,562	117,232	-	-	**123,048**
Rocket	162	1,398	16,866	14,500	10,584	1,074,038	1,199,166	4,359,422	-	**6,676,136**
Total Pounds	**11,823**	**251,087**	**1,649,865**	**2,184,801**	**1,945,615**	**58,846,144**	**157,278,848**	**378,613,052**	**11,077,104**	**611,858,339**

Table A4.3 **Total amount of ordnance (pieces) dropped on communes of A Luoi District, 1965 to 1973, by ordnance type (source: US Military Archives).**

Commune	Category of ordnance										Total
	Ammunition	Chemical	Cluster bomb	Flare	Gen. purpose	Incendiary	Mine	Missile	Rocket	Other	
A Dot	928	1	111	-	2,892	52	38	-	300	-	**4,322**
A Luoi	1,529	-	79	-	3,694	58	24	-	386	39	**5,809**
A Ngo	732	8	54	1	1,962	39		600	1,926	7	**5,329**
A Roang	254	2	48	-	4,420	58	32	-	320	20	**5,154**
Bac Son	840	8	139	-	2,608	156	16	-	716	9	**4,492**
Dong Son (A So)	763	8	193	17	3,045	115		-	1,116	-	**5,257**
Hong Bac	1,995	5	131	18	6,528	250		-	589	27	**9,543**
Hong Ha[1]	4,324	-	581	-	30,711	734	258	6	2,019	24	**38,657**
Hong Kim	1,138	20	187	5	8,872	142	12	-	542	18	**10,936**
Hong Quang	94	4	42	-	1,236	19	-	-	197	-	**1,592**
Hong Thai	803	-	88	-	4,470	172	10	-	842	12	**6,397**
Hong Thuong	2,524	-	254	4	10,788	89	15	-	737	18	**14,429**
Hong Thuy[1]	2,729	36	352	-	19,055	471	45	58	1,631	34	**24,411**
Hong Trung	5,211	13	521	37	18,356	440	67	24	1,878	65	**26,612**
Hong Van	8,373	86	965	42	29,971	428	139	46	3,093	149	**43,292**
Huong Lam	2,487	-	332	1	10,028	295	162	-	629	25	**13,959**
Huong Nguyen	1,953	-	463	38	30,913	505	99	-	1,061	35	**35,067**
Huong Phong	2,184	-	220	4	11,450	422	46	3	1,432	24	**15,785**
Phu Vinh	3,196	-	245	-	10,948	371	88	-	1,122	15	**15,985**
Son Thuy	844	-	95	159	3,467	50	6	-	273	47	**4,941**
Xa Nham	887	-	79	-	4,671	275	4	8	614	1	**6,539**
Total	**43,788**	**191**	**5,179**	**326**	**220,085**	**5,141**	**1,061**	**745**	**21,423**	**569**	**298,508**

[1] Incomplete Air Combat Database records used for Hong Ha and Hong Thuy communes. Values in these tables likely underestimate actual amounts of ordnance dropped on these communes.

Table A4.4 Total weight of ordnance (millions of pounds) dropped on communes of A Luoi District, 1965 to 1973, by ordnance type (source: US Military Archives).

Commune	Category of ordnance										Total
	Ammunition	Chemical	Cluster bomb	Flare	Gen. purpose	Incendiary	Mine	Missile	Rocket	Other	
A Dot	56,431	355	176,885	-	4,599,931	169,970	1,531	-	96,982	-	**5,102,085**
A Luoi	89,710	-	440,652	-	9,042,527	235,742	71,504	-	61,786	-	**9,941,921**
A Ngo	68,415	14,355	305,975	25	5,333,931	111,244	-	5,386,816	3,896,364	-	**15,117,125**
A Roang	27,978	355	56,021	-	7,991,841	68,324	117,184	-	106,518	-	**8,368,221**
Bac Son	117,146	14,355	767,122	-	4,972,486	611,078	58,592	-	1,006	-	**6,541,785**
Dong Son (A So)	47,366	28,000	403,771	75	8,507,424	180,254	-	-	21,566		**9,188,456**
Hong Bac	122,187	14,355	506,733	25	11,420,638	293,356	-	-	1,404	87,232	**12,445,930**
Hong Ha[1]	300,164	-	2,650,971	-	97,373,001	3,401,190	991,588	18,922	446,176	-	**105,182,012**
Hong Kim	105,072	16,130	958,372	25	14,579,541	304,572	35,752	-	49,552	2,144	**16,051,160**
Hong Quang	20,843	14,000	176,216	-	3,297,670	35,820	-	-	17,690	-	**3,562,239**
Hong Thai	93,243	-	327,053	-	7,262,205	348,665	57,100	-	1,254	-	**8,089,520**
Hong Thuong	80,819	-	1,314,402	50	23,609,724	173,746	36,283	-	3,348	-	**25,218,372**
Hong Thuy[1]	239,989	45,550	1,229,314	-	37,198,656	969,132	191,414	317,527	646,952	90	**40,838,624**
Hong Trung	463,985	28,710	2,610,158	25	39,501,957	1,352,088	278,126	132,182	268,566	30,090	**44,665,887**
Hong Van	494,798	42,200	4,296,118	75	66,032,249	882,555	378,438	425,932	269,372	2,742	**72,824,479**
Huong Lam	189,471	-	887,321	25	31,124,330	899,774	602,176	-	36,226	750	**33,740,073**
Huong Nguyen	227,044	-	2,214,795	25	106,149,694	1,303,838	434,218	-	158,650	-	**110,488,264**
Huong Phong	244,535	-	660,674	25	29,691,258	1,307,310	164,356	402	56,352	-	**32,124,912**
Phu Vinh	222,504	-	1,065,413	-	27,991,085	806,322	271,612	-	516,082	-	**30,873,018**
Son Thuy	51,939	-	376,741	50	9,867,388	154,622	34,260	-	17,876	-	**10,502,876**
Xa Nham	32,157	-	173,445	-	4,230,134	199,649	22,840	40,531	2,018	-	**4,700,774**
Total	**3,295,796**	**218,365**	**21,598,152**	**425**	**549,777,670**	**13,809,251**	**3,746,974**	**6,322,312**	**6,675,740**	**123,048**	**605,567,733**

[1] Incomplete Air Combat Database records used for Hong Ha and Hong Thuy communes. Values in these tables likely underestimate actual amounts of ordnance dropped on these communes.

Table A4.5 **Density of ordnance (pieces/km^2) dropped on communes of A Luoi District, 1965-1973, by ordnance type (source: US Military Archives).**

Commune	Area (km2)	Category of ordnance										Total
		Ammunition	Chemical	Cluster bomb	Flare	Gen. purpose	Incendiary	Mine	Missile	Rocket	Other	
A Dot	17.5	53.0	0.1	6.3	-	165.3	3.0	2.2	-	17.1	-	**247**
A Luoi	13.6	112.8	-	5.8	-	272.4	4.3	1.8	-	28.5	2.9	**428**
A Ngo	8.7	84.0	0.9	6.2	0.1	225.3	4.5	-	68.9	221.1	0.8	**612**
A Roang	57.1	4.4	0.0	0.8	-	77.4	1.0	0.6	-	5.6	0.4	**90**
Bac Son	10.4	80.7	0.8	13.4	-	250.5	15.0	1.5	-	68.8	0.9	**432**
Dong Son (A So)	26.5	28.7	0.3	7.3	0.6	114.7	4.3	-	-	42.0	-	**198**
Hong Bac	31.3	63.7	0.2	4.2	0.6	208.4	8.0	-	-	18.8	0.9	**305**
Hong Ha[1]	182.9	23.6	-	3.2	-	167.9	4.0	1.4	0.0	11.0	0.1	**211**
Hong Kim	41.4	27.5	0.5	4.5	0.1	214.5	3.4	0.3	-	13.1	0.4	**264**
Hong Quang	5.5	17.2	0.7	7.7	-	226.8	3.5	-	-	36.1	-	**292**
Hong Thai	69.8	11.5	-	1.3	-	64.0	2.5	0.1	-	12.1	0.2	**92**
Hong Thuong	40.0	63.1	-	6.3	0.1	269.6	2.2	0.4	-	18.4	0.4	**361**
Hong Thuy[1]	145.3	18.8	0.2	2.4	-	131.1	3.2	0.3	0.4	11.2	0.2	**168**
Hong Trung	65.7	79.4	0.2	7.9	0.6	279.6	6.7	1.0	0.4	28.6	1.0	**405**
Hong Van	41.3	202.9	2.1	23.4	1.0	726.4	10.4	3.4	1.1	75.0	3.6	**1,049**
Huong Lam	50.6	49.1	-	6.6	0.0	198.1	5.8	3.2	-	12.4	0.5	**276**
Huong Nguyen	281.9	6.9	-	1.6	0.1	109.7	1.8	0.4	-	3.8	0.1	**124**
Huong Phong	81.4	26.8	-	2.7	0.0	140.6	5.2	0.6	0.0	17.6	0.3	**194**
Phu Vinh	28.6	111.7	-	8.6	-	382.7	13.0	3.1	-	39.2	0.5	**559**
Son Thuy	15.8	53.3	-	6.0	10.0	219.0	3.2	0.4	-	17.2	3.0	**312**
Xa Nham	37.8	23.4	-	2.1	-	123.5	7.3	0.1	0.2	16.2	0.0	**173**
Total	**1,253**	**1,143**	**6**	**128**	**13**	**4,567**	**112**	**21**	**71**	**714**	**16**	**6,792**

[1] Incomplete Air Combat Database records used for Hong Ha and Hong Thuy communes. Values in these tables likely underestimate actual amounts of ordnance dropped on these communes.

Table A4.6 **Density of ordnance (pounds/km^2) dropped on communes of A Luoi District, 1965-1973, by ordnance type (source: US Military Archives).**

Commune	Area (km2)	Category of ordnance										Total
		Ammunition	Chemical	Cluster bomb	Flare	Gen. purpose	Incendiary	Mine	Missile	Rocket	Other	
A Dot	17.5	3,225	20	10,108	-	262,853	9,713	87	-	5,542	-	**291,548**
A Luoi	13.6	6,616	-	32,496	-	666,853	17,385	5,273	-	4,556	-	**733,180**
A Ngo	8.7	7,855	1,648	35,129	3	612,392	12,772	-	618,463	447,344	-	**1,735,606**
A Roang	57.1	490	6	981	-	139,889	1,196	2,051	-	1,864	-	**146,477**
Bac Son	10.4	11,253	1,379	73,691	-	477,664	58,701	5,628	-	97	-	**628,414**
Dong Son (A So)	26.5	1,785	1,055	15,214	3	320,551	6,792	-	-	813	-	**346,212**
Hong Bac	31.3	3,900	458	16,174	1	364,527	9,363	-	-	45	2,784	**397,253**
Hong Ha[1]	182.9	1,641	-	14,493	-	532,326	18,594	5,421	103	2,439	-	**575,016**
Hong Kim	41.4	2,540	390	23,166	1	352,418	7,362	864	-	1,198	52	**387,990**
Hong Quang	5.5	3,824	2,569	32,333	-	605,077	6,572	-	-	3,246	-	**653,622**
Hong Thai	69.8	1,335	-	4,684	-	104,013	4,994	818	-	18	-	**115,863**
Hong Thuong	40.0	2,019	-	32,844	1	589,948	4,341	907	-	84	-	**630,144**
Hong Thuy[1]	145.3	1,652	313	8,460	-	255,995	6,669	1,317	2,185	4,452	1	**281,045**
Hong Trung	65.7	7,066	437	39,753	0	601,614	20,592	4,236	2,013	4,090	458	**680,260**
Hong Van	41.3	11,992	1,023	104,123	2	1,600,394	21,390	9,172	10,323	6,529	66	**1,765,014**
Huong Lam	50.6	3,742	-	17,526	0	614,741	17,772	11,894	-	716	15	**666,405**
Huong Nguyen	281.9	805	-	7,856	0	376,538	4,625	1,540	-	563	-	**391,927**
Huong Phong	81.4	3,004	-	8,115	0	364,713	16,058	2,019	5	692	-	**394,606**
Phu Vinh	28.6	7,777	-	37,239	-	978,367	28,183	9,494	-	18,039	-	**1,079,099**
Son Thuy	15.8	3,281	-	23,799	3	623,335	9,768	2,164	-	1,129	-	**663,479**
Xa Nham	37.8	850	-	4,585	-	111,820	5,278	604	1,071	53	-	**124,260**
Total	**1,253**	**86,653**	**9,299**	**542,768**	**15**	**10,556,027**	**288,121**	**63,489**	**634,165**	**503,508**	**3,376**	**12,687,420**

[1] Incomplete Air Combat Database records used for Hong Ha and Hong Thuy communes. Values in these tables likely underestimate actual amounts of ordnance dropped on these communes.

Appendix A5

Imstrat Corporation Report on Corona Imagery Processing and Analysis

ImStrat Corporation

CORONA IMAGERY USEABILITY ASSESSMENT
Phase 2
CORONA Technical Demonstration
June 2001

Suite 100, 20 Bennett Street
Carleton Place, Ontario
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1.0 INTRODUCTION

1.1 This report is a technical description of a demonstration using CORONA satellite imagery supplied by Hatfield and Associates. It is in support of Hatfield Consultants proposal called 'DEVELOPMENT OF METHODOLOGIES AND TECHNOLOGY FOR SUPPORTING UXO CLEARANCE ACTIVITIES IN VIET NAM.' It consists of a report outlining the processes and methodologies used in the development of bomb damage information extracted image maps, hard copy image map examples and next step recommendations.

2.0 PROCESSES AND METHODOLOGIES

2.1 In order to demonstrate the feasibility of the use of CORONA satellite imagery in support of Hatfield and Associates proposal, the A Luoi Valley in Vietnam was selected as the area of interest. CORONA imagery from 1967 and 1968 of the area of interest was used.

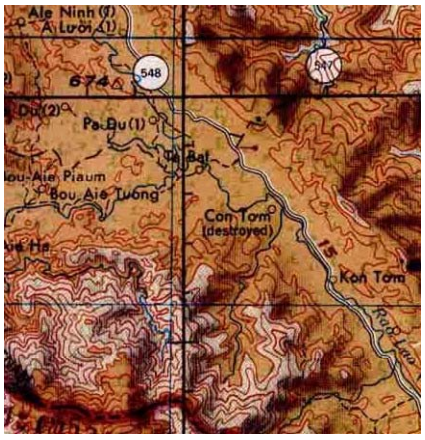


Figure 1 A Luoi Valley, Vietnam

JOG (Land) 1:250,000 Scale

2.2 The first step was to get the CORONA hard copy positive satellite imagery digitized. This was achieved using a very high resolution drum roll scanner with the following output parameters:

2.2.1 Digital Specifications:
2.2.1.1 Scanned at 1200 dpi
2.2.1.2 Dynamic Range: 8bit
2.2.1.3 File Format: TIFF
2.2.1.4 Media: CD-ROM

2.3 Upon receiving the digitized CORONA imagery, both images were geo-referenced. The first image to be geo-referenced was the 1967 image[1]. This was done by conducting an "image to map" geo-referencing process using Hatfield and Associates supplied 1:50,000 scale maps of the area of interest. The 1968 image was geo-referenced by conducting an "image-to-image"

[1] Ortho-rectification of the CORONA data is not possible at this time. Digital Elevation Model data for the area of interest is required in order for this to be achieved.

geo-referencing process using the already geo-referenced 1967 image[2]. The following process and parameters were used for both images:

2.3.1 Geo-Referencing[3]:

2.3.1.1 Ground Control Points (GCP) used: six
2.3.1.2 Warp: 1st order Polynomial, Nearest Neighbour
2.3.1.3 Projection: UTM Zone 48
2.3.1.4 Datum: WGS 84
2.3.1.5 Pixel Resolution: 8 metre
2.3.1.6 Output format: ENVI

2.4 The next step was conducting an interactive contrast stretch on both geo-referenced products until the desired levels were met for feature extraction.

2.5 Upon completion of the geo-referencing of both data sets, basic feature identification was conducted using the 1967 image. Basic features included:

2.5.1 Basic Features (1967 image):
2.5.1.1 Villages and Towns
2.5.1.2 Roads
2.5.1.3 Bridges
2.5.1.4 Airfields

2.5.2 This information was stored in individual geo-referenced vector overlays. In addition, any assessed bomb damage within the 1967 image was extracted and put into a vector overlay.

2.6 The next step taken was the detailed feature extraction of bomb-damaged areas identified within the 1968 image. The bomb damaged areas were further categorized into the following levels:

2.6.1 Bomb Damage Categories:

2.6.1.1 Strategic Bombing
2.6.1.2 Interdiction Operations
2.6.1.3 Close Air Support
2.6.1.4 Mixed Bombing areas[4]

2.7 Upon completion of the vector overlays, image maps were created using sub-image sets of the areas of interest, (see Annex A).

[2] The software used in all processing and feature extraction for this project is Research Systems ENVI 3.4 remote sensing software.
[3] The horizontal accuracy is estimated at +/- 100m.
[4] Further analysis is required for these areas of interest.

2.8 The sub-image sets were then exported into GeoTIFF 8 bit grayscale images. While all vector overlays were exported into ArcView Shape files.

3.0 NEXT STEP RECOMMENDATIONS

3.1 The following are recommendations for the process of developing more detailed geospatial products:

3.1.1 Ortho-rectification

Digital Elevation Models of the Area of Interest should be obtained in order for a full orthorectification of the CORONA imagery to take place. This will increase the spatial accuracy of the imagery exponentially.

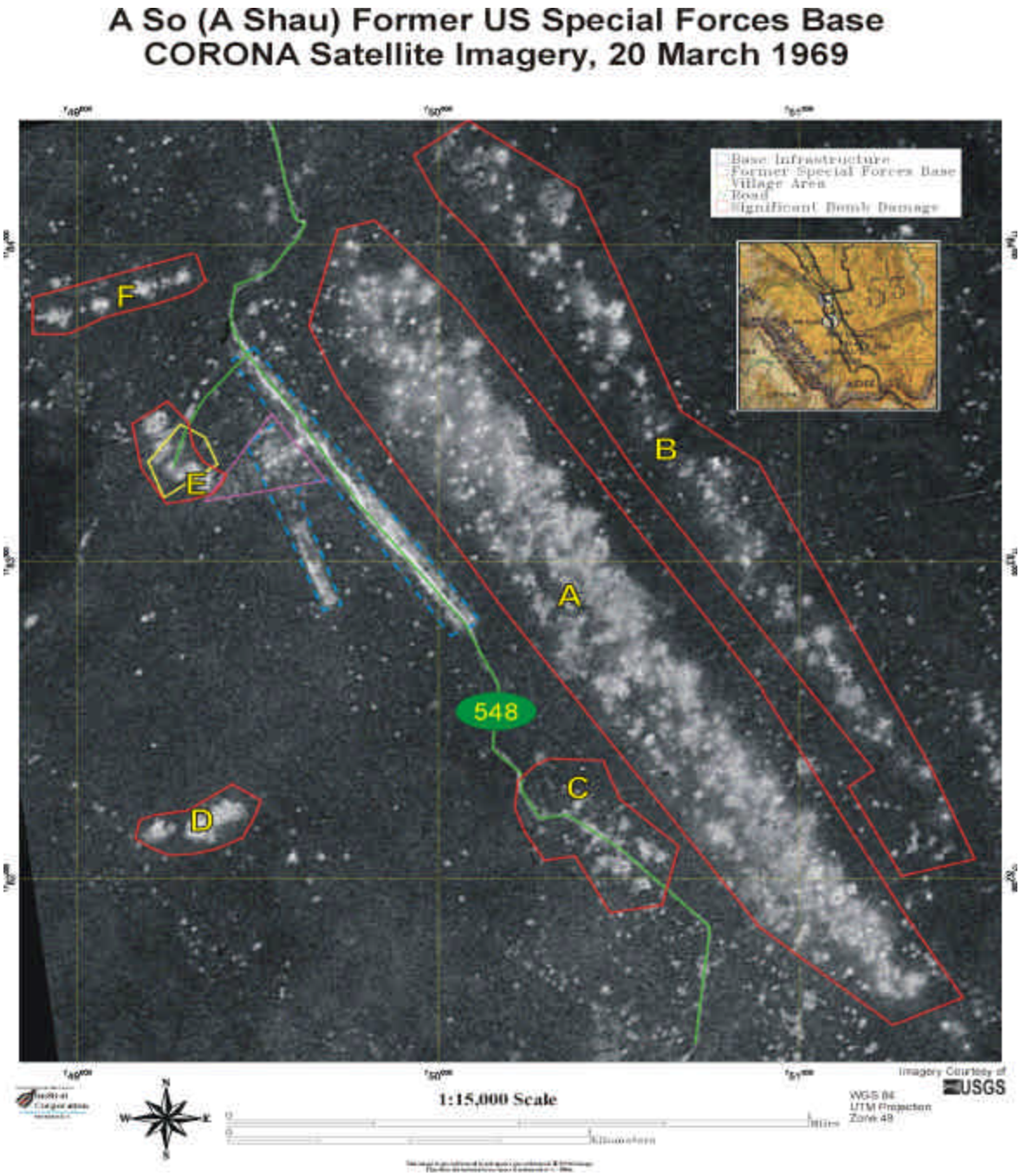
3.1.2 Imagery Analysis

Further detailed imagery analysis of the area of interest is required. Specifically, the mixed bomb damaged areas require further analysis.

4.0 CONCLUSION

4.1 This technical demonstration clearly shows the validity of not only the CORONA imagery itself, but also the processes used in the creation of usable geospatial information products from the imagery, in support of Hatfield and Associates Proposal called, 'DEVELOPMENT OF METHODOLOGIES AND TECHNOLOGY FOR SUPPORTING UXO CLEARANCE ACTIVITIES IN VIET NAM.'

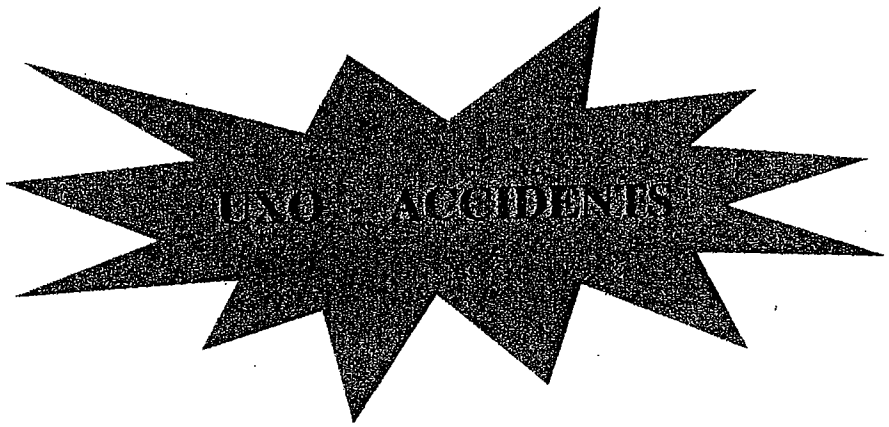
ANNEX A – Image Maps



Appendix A6

UXO & Accidents Survey Methodology and UXO Awareness Education Program

CIDA UXO PROJECT



UXO & ACCIDENTS SURVEY METHODOLOGY

UXO AWARENESS EDUCATION PROGRAM

IN A LUOI VALLEY

Prepared by 10-80 Committee

April, 2001

DOCUMENT

A. INTRODUCTION :

A Luoi that is a mountain area of Thua Thien Hue Province had been jungle forest area before 1960 and had had some sparse tribes such as Paco, Pahy, Ca Tu, Ta Oi...

The A Luoi valley is situated in A Luoi District approximately 65 km southwest of the city of Hue along western side of Thua Thien Hue Province in central of Viet Nam. The A Luoi District covers 116,642 ha. Itsmain feature is the A Luoi valley, which is approximately 30 km long, 3 km wide and surrounded by mountains in height from 700m to more than 1,000 m. The district's topography is mountainous; the A Luoi valley is visible at ~ 600 m elevation. It is orientated from northwest to southwset in the district wsetern region.

The A Luoi valley borders Laos to the west and was a major supply route along Ho Chi Minh Trail from northern to southern Viet Nam during the war. The valley was of great strategic importance to the northern Vietnamese army moving into southern Viet Nam; considerable American efforts were spent to limit the flow of personel and material through this region. To limit the ability of northern troops to move under cover, the A Luoi Valley was heavily bombed and sprayed with herbicides, between 1965-1970.

Since after the war, a large amount of UXO has still remained and continous causing accidents for human, animals ... in A Luoi valley. The UXO & accidents survey will give us a comprehensive acknowledgment about UXO's impacts to human health, limiting agricultural activities and socio-economical development, it also provide us the indispensable data to design the UXO clearance operation in A Luoi valley.

In addition, while we are waiting for an enough finance of the UXO clearance operation, we should carry out a UXO awareness education program for A Luoi inhabitant in order to prevent them from UXO accidents. This program is required a small budget, but it will bring to A Luoi inhabitant a basis knowledg that how should they do to protect themself from UXO awareness.

See annex 1 (US CORONA Satellite image of the A Luoi Special Forces base)

B. SURVEY METHODOLOGY

1. Survey coverage :

- *Survey area*

Actually, A Luoi was a strategy importance area during the war, so whole of A Luoi valley had confliction between U.S army and Vietnamese troops. Therefore whole of A Luoi valley was used bomb and mine by both of two conflicted sides. The survey will be carried out in total 21 communes and 1 town of A Luoi valley, however, we should concentrate in areas that had old army base during the war.

- *UXO interviewee* :

. The first interviewees who will be collected for the survey are VN veteran and A Luoi old original people. The number of survey interviewees is 100 people/1 commune, so the total number of them will be 2,200 people. This working will done by the interviewer who are members of Hue Defence Department.

. The second interviewees who will be collected for the survey are UXO's victims and UXO's died victims' families (after the war).

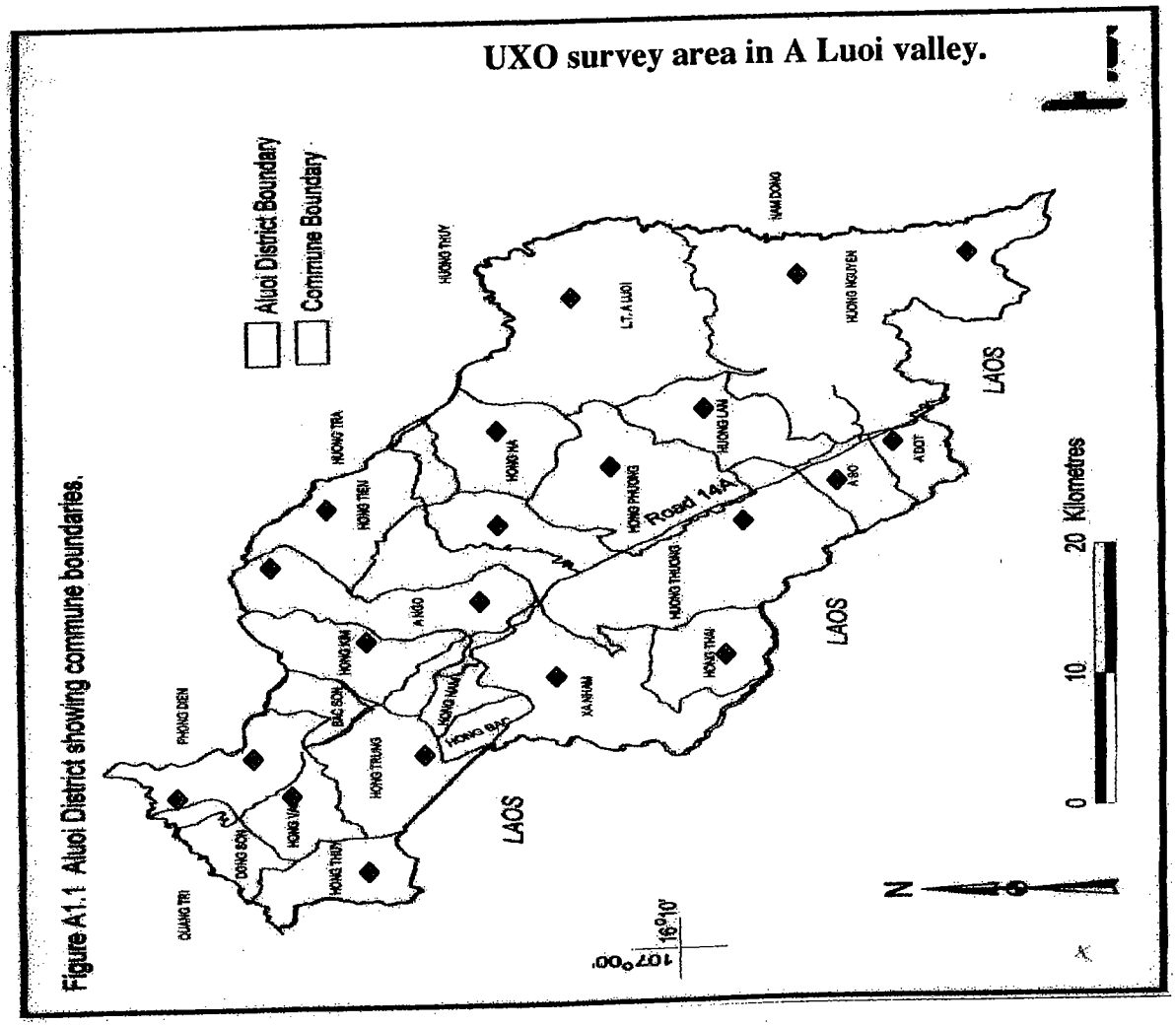


Figure A1.1 Aluoi District showing commune boundaries.

2. **Data resource** :

Data will be collected by two resources:

2.1 *Qualitative data*

We will collect all data related UXO during the war and after the war from Hue Defence Department and A Luoi Defence Department. Most of those data has kept as archives by Viet Nam Defence Ministry, HDD, ALDD collected during and after the war. For example :

- Bomb sprayed and mine used map
- Types of bombs and mines was used during the war
- Estimated UXO's amount in A Luoi area
- Plans for UXO clearance operation by HDD
- Others

2.2 *Quantitative data* :

Quantitative information will provide the survey with more precise figures and locations in comparison with the qualitative data. Two different questionaires will be used to collect quantitative information from every commune in A Luoi District during the survey. Commune interviews will be conducted by trained interviewers under the coordination and the supervision of 10-80 Committee, HDD and HHD.

. A six-page commune questionaires will be used to collect information about: The presence of UXO; the location and extent of UXO contamination and the types of UXO observed. The questionaire also show information about the location of battlefields, fortifications and aerial bombardment that occured during the war. A copy of commune questionaire can be found in appendix 2.

. A two-page accident report form will be used to identify: The age and gender of the victim; the location of the accident; the activity during the accident; the type of UXO involved; if known, the outcome of the accident (death or types of injuries); and the socio-economic status of surviving victims. The accident interviews will be conducted following the completion of the commune questionaire. The victim will be interviewed if still living, otherwise a close relative provided the information. Accident data will be cross-checked to prevent duplicate records of a single UXO-related accidents, as well as to minimise errors based on oral history. The families of victim will be interviewed if died. a copied Accident form can be found in appendix 3.

3. **Survey organization and network management**

10-80 Committee will co-operate with HHD, HDD and ALPC to implement the survey as following steps as below:

- Make the plans and the schedule of the survey
- Contact with ALPC and do an explaining operation for AL inhabitant about the purposes of the survey.
- Choose data-collectors who are members of local health center and HDD.
- Train for data-collectors interviewing interviewee and filling questinonaires.
- Data will be collected in every interviewee each commune by data-collectors and will be supervised by 10-80 Com., HHD and HDD.
- Data will be inputed into computer and analysed by 10-80 Committee.
- Produce the final report by the collaboration of 10-80 Com., HHD and HDD.

Survey organization

2 advisors (1 of HDD -technician, 1 of 10-80 - survey)

3 survey Trainer (1 of HHD, 1 of 10-80. HDD)

4 supervisors (HDD, HHD, 10-80, ALPC)

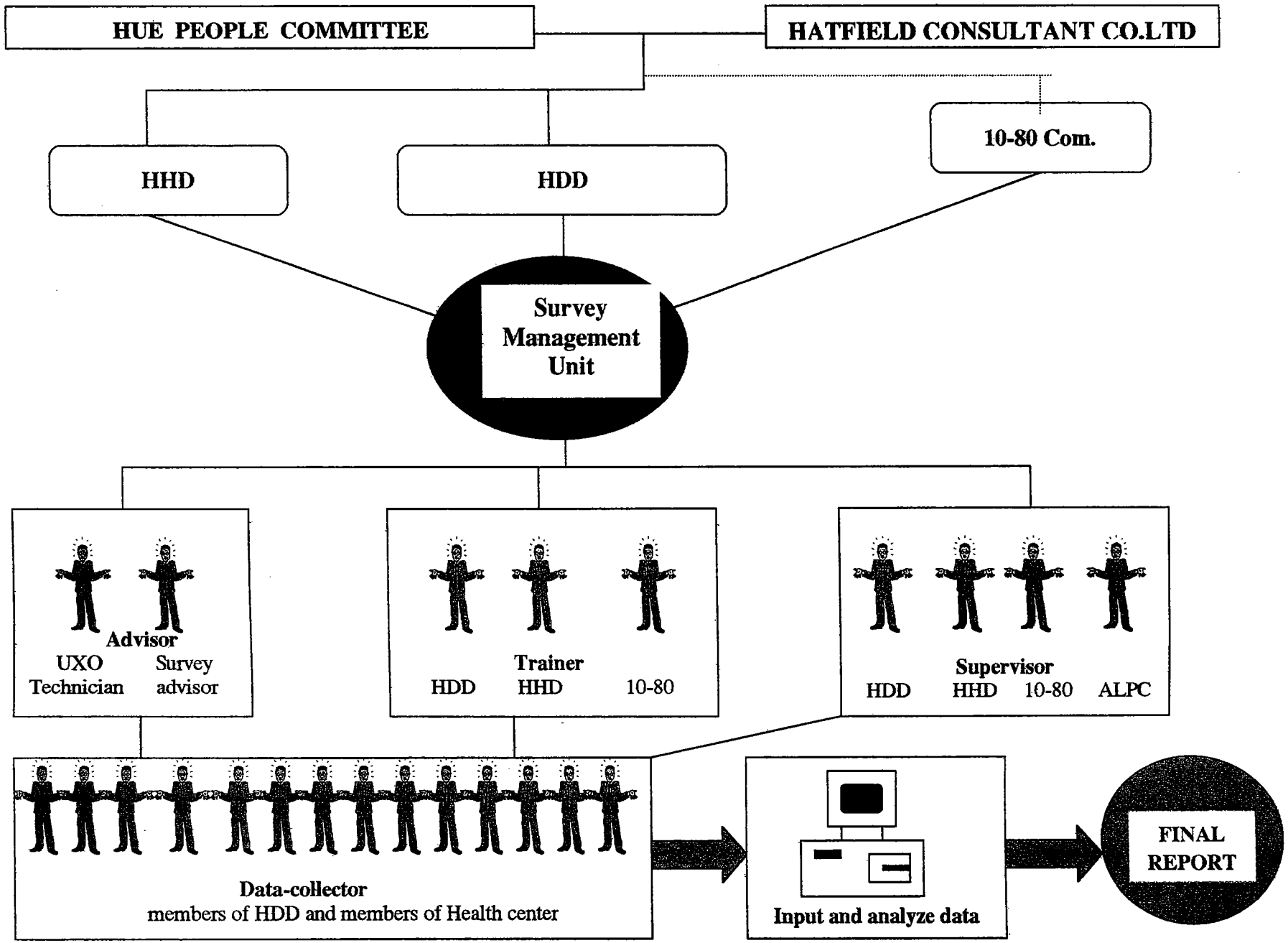
14 data-collectors (divide into 7 groups : 1 medical technician + 1 HDD technician per one group)

Survey trainning

Trainning place : A Lưới

Trainning time : 3 days

Trainee : members of local health center and HDD


HUE PEOPLE COMMITTEE
HATFIELD CONSULTANT CO.LTD
HHD
HDD
10-80 Com.
Survey Management Unit
Advisor
UXO Technician
Survey advisor
Trainer
HDD
HHD
10-80
Supervisor
HDD
HHD
10-80
ALPC
Data-collector
members of HDD and members of Health center
Input and analyze data
FINAL REPORT

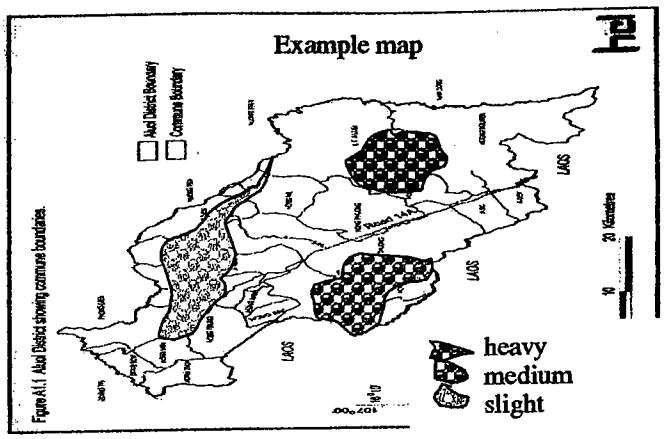
3. Data structure and data analysis:

The data that is collected will be inputed into computer and analyzed by EPI INFO 6.0 program. The outcome product of this working will be contributed as following the data-structure as below :

UXO situation

3.1 The UXO contaminated maps will be produced by the data collected by HDD (see example below).

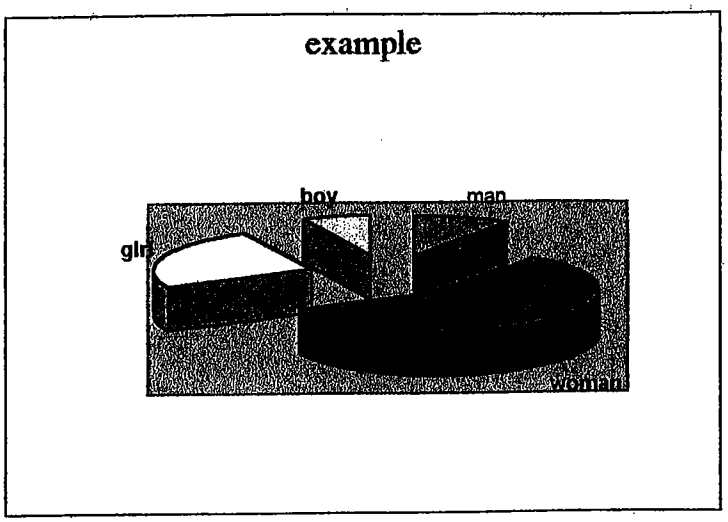
Time	Position	number of mission
58-60	-	-
61-62	-	-
62-63	-	-
63-64	-	-
64-65	-	-
65-66	-	-
66-67	-	-
67-68	-	-
68-69	-	-
69-70	-	-
70-72	-	-



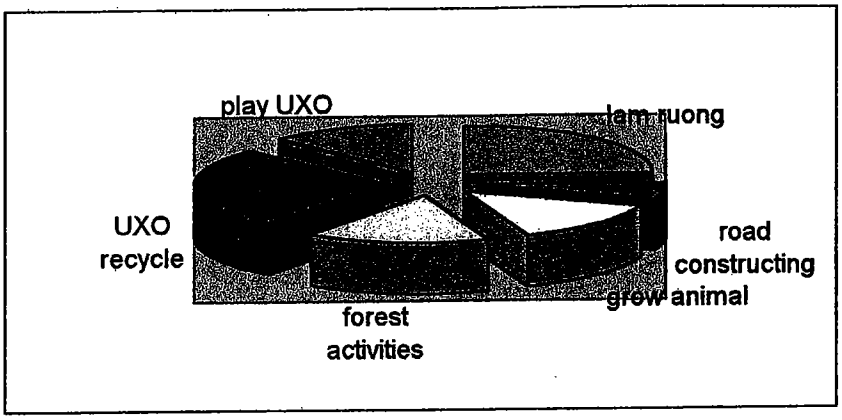
3.2 Type of land affected
(see example below)

Area	Number of commune
Center	
Road	
Agricultural area	
Grass land	
Forest	
Other	
Total area	

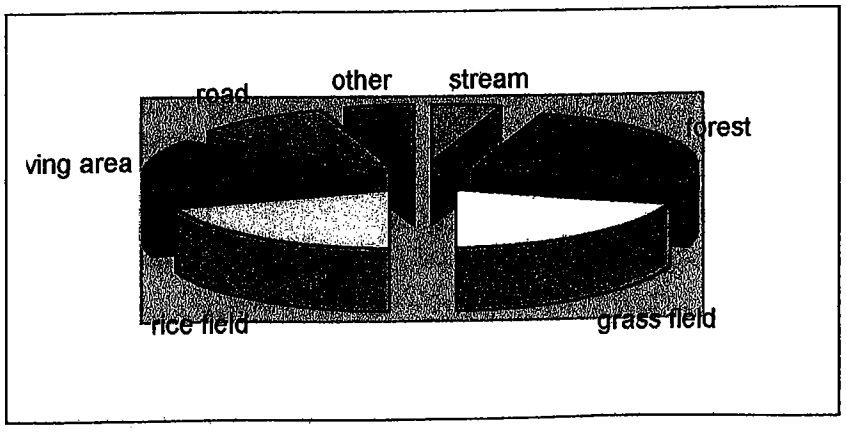
3.6 Affected groups



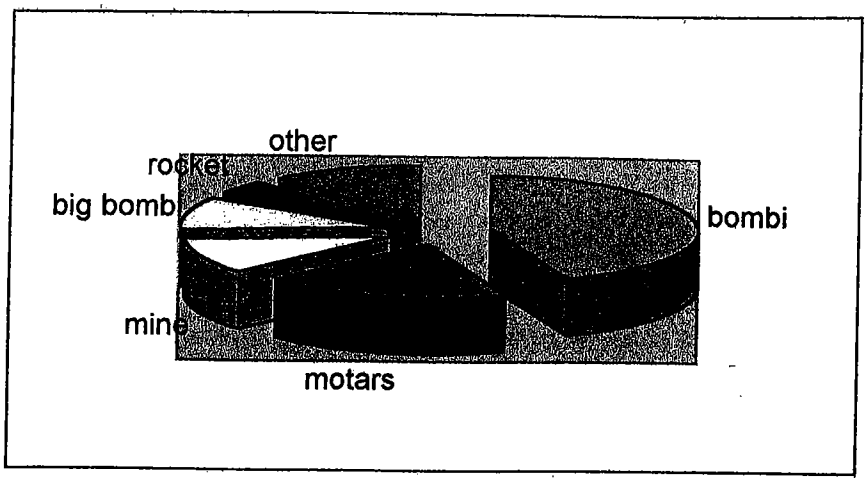
3.7 Activities resulting in UXO - related accidents



3.8 Location of UXO accidents



3.9 Types of UXO responsible for accidents



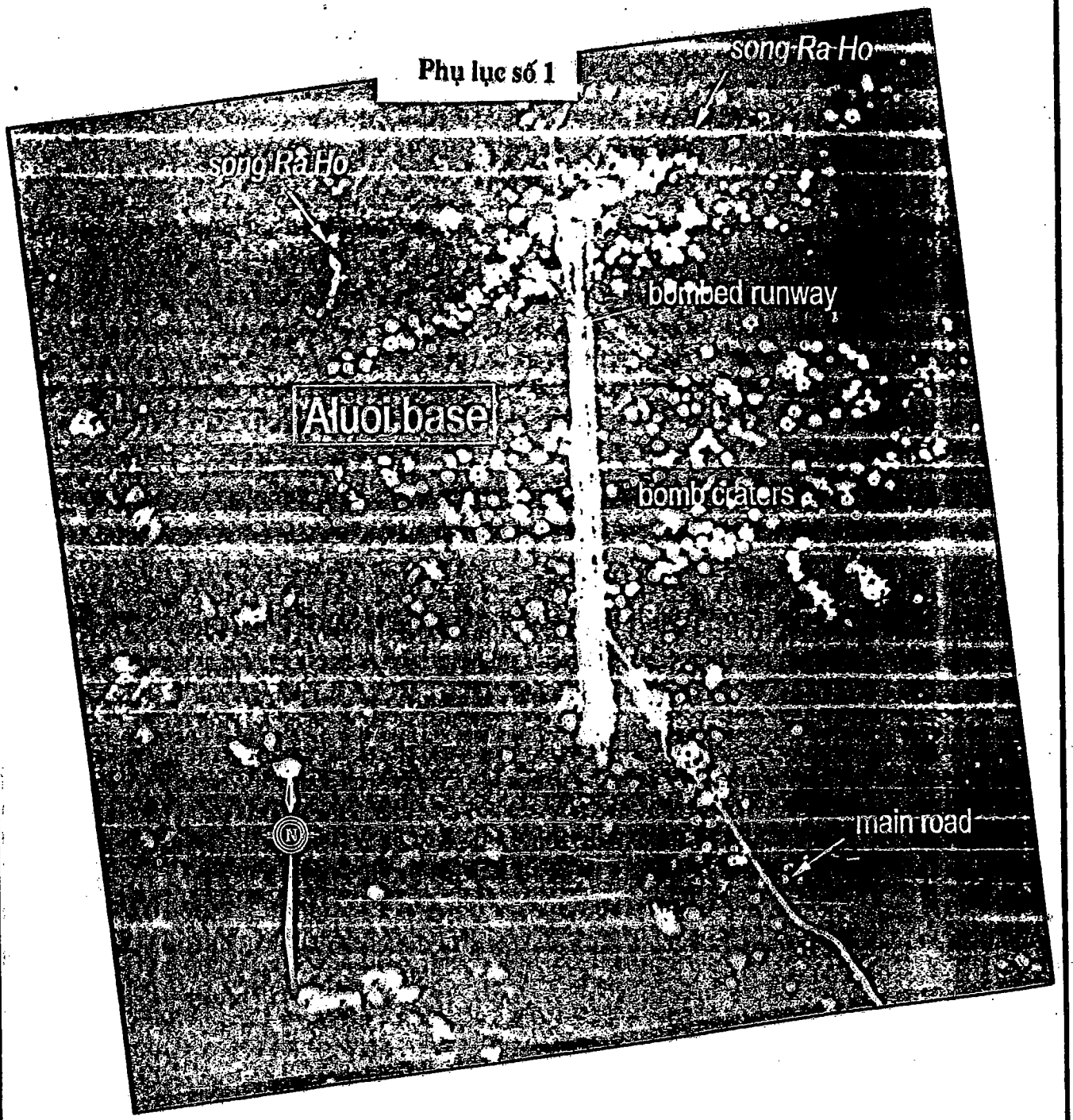
Other information

3.10 Physical and medical impact of UXO
- Types of UXO and injuries they cause
- Types of injuries in relation to activities at the time of accidents
- Types of disability caused by UXO
- Hospital and local medical center coverage of victims
- Implication of UXO for medical and support services

3.11 Attitude and awareness
- Behaviour towards UXO
- Children and UXO
- Villagers' perceptions of different UXO
- Recycling of UXO villagers

3.12 Analysis of the socio-economic impact of UXO
- Impact on the village community
- Hardships caused by the death of a family member
- Financial burden of UXO accidents
- Attitudes toward disability
- Restrictions onland use due to UXO
- Types of land impacted
- Village relocation in UXO contaminated areas
- Use of agricultural equipment and UXO accidents
- Impact on irrigation schemes
- Impact on the national road system
- UXO mitigation plan of local agencies.

Appendix 1 US CORONA Satellite image of the Aluoi Special Forces base, Aluoi Valley, Viet Nam, 1968; the base was abandoned and demolished by US forces in December 1965.



Appendix 2 : Questionaire 1

COMMUNE FORM

Box 1 - to be filled by the supervisor

1. Commune name:	**2. Dân số của Xã:**		**Commune code:**
3. Other name of the same village (from district or people...)			
4. District name:	**5. Province name :**		
6. Supervisor name:	**7. Office:**		**8. Position:**
	9. Age:	**10. Sex:** Male Female	**11. Involved the war ?** Yes No

Box 2 - to be filled by data-collector

1. Interviewer name:	**2. Commune:**		**3. Occupation ?**
	4.Age:	**5.Sex:** Male Female	**6. Involved the war?** Yes No

Box 3 - to be filled by data-collector

1. Interviewee name:	**2. Age:**	**3. Sex**	**4.Occupation:**	**5. when have you lived here ?**
6. Have you seen any UXO in the village ?	No Few Many Everywhere			
7. Date of the interview (DD/MM/YY)	**8. Finish time:**			**9. Estimated duration(')**

Box 4 - To be filled by data-collector

1. When did your village settle here ? ➡	Before the war ☐ After the war ☐	When ?
2. Previous name of the commune ➡		
3. How do you live here ➡	Permanently ☐ Temporary ☐	
4. Did you live here during the war ? Yes No	If no, Where:	From : To:

Box 5 - to be filled by data-collector

Was your commune bombed by aircraft during the war ?

No Yes ➡ 1. How many time ? : 1☐ 2-5 ☐ 6-50 ☐ >50 ☐

Do not know

	Year	or Season	Month
When did it begin ?		Spring Summer Autumm Winter	
When did it finish ?		Spring Summer Autumm Winter	

2. How many bomb craters are there still now in the area of your commune ?:

a. Small (like buffalo watering hole): b. Big (like a house) :

3. Did any aeroplane crash in the territory of your commune ?

Yes No

Box 6 - to be filled by data-collector

Were there any ground battles in the territory of your commune during the war ?

No Yes ➡ What kind ? Airbase Army station Other

Do not know

Where was it from the village center ?

? km or m:	Which direction ?
	East West South North East-north West-south East-south West-North

Box 7 - to be filled by data-collector

1. Are there any unexploded bombs or bombies (UXO) in your commune ?

No Yes Do not know

2. Are there any land mines in your commune ?

No Yes Do not know

Box 8 - to be filled by data-collector

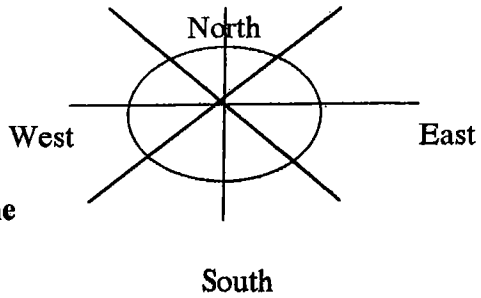
1. In what kind of land or places did you see some UXO ?

near house in commune	on or along path of road	Rice field	moutain area	Grazzing land	near forest	in forest	other	every where

2. From here, where are the areas where you see some UXO

All over the commune Only in few area

(Which direction ?)



3. How many families of the commune have visible UXO/Mine on their field ?

4. What is the total area of agricultural land where you see UXO ? :

Box 9 - to be filled by data-collector

1. What have you been doing when seeing UXO ?

Inform to authorities of commune and District ? Yes No	Throw to other place ? Yes No	Recycle it ? Yes No	Other - tell ?

2. What have your inhabitant been doing when seeing UXO ?

Inform to authorities of commune and District ? Yes No	Throw to other place ? Yes No	Recycle it ? Yes No	Other - tell ?

Box 10 - to be filled by data-collector

1. Is there any idle land you would like to use but cannot use due to the presence of UXO ?
- How large would you need ?

Land field	Grazzing land	Housing	Reforestation	Other - tell ?

Box 11 - to be filled by data-collector

1. Since the end of the war, did any person in your family get injured or die due to UXO ?
No Yes ➡ How many persons ? :

2. Since the end of the war, howmany people in your commune get injured or die to UXO ?

Male:	Female:	Children :	Total :

If possible, give me name of victims

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

3. Since the end of the war, did any animal of your commune die because of UXO? :
No Yes ➡ How many :

Buffalo:	Cow:	Pig:	Chicken, duck:	Other:

Box 12 - to be filled by data-collector

1. Have you ever seen people searching for UXO or scrap metal with metal detectors ?
No Yes ➡ When did you see ? :
Who are they ? :

Box 13 - to be filled by data-collector

1. Are there any program of Government (commune, District, province...) **to solve the UXO problem in your commune ?** No Yes

2. Are there any supporting from District or commune for UXO's education ?

No Yes ➡ Which way ? : Education ☐
Provide equipment ☐
Make abanded area ☐

Box 14- to be filled by data-collector

1. Since beginning of the war and aside from the bombings, have you ever seen any other effects due to the aeroplanes on the territory of your commune No Yes ➡

All the foliage of the trees in the forest becoming yellow and dying	No Yes	When	Howmany time
All rice leaves turning yellow and dying leading to no havest at all	No Yes		
All the fishes dying very suddenly	No Yes		
Many other animals dying suddenly	No Yes		
Most of the people suffering from eye burning	No Yes		
Most of the people suffering from skin burning	No Yes		
Most of the people suffering from respiratory suffocation	No Yes		
Most of the people suddenly dying	No Yes		
Other effects:			

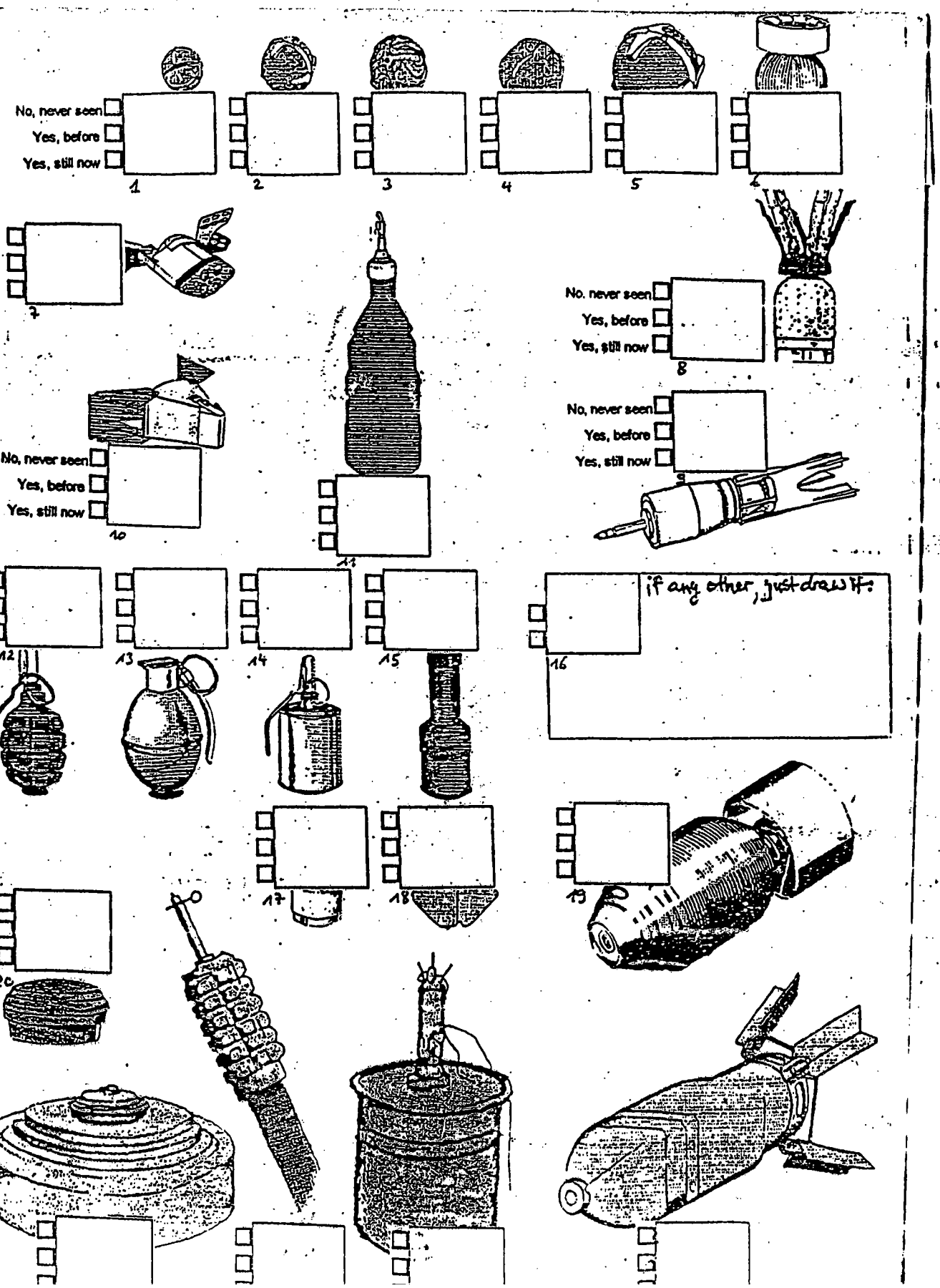
Box 15 - to be filled by data-collector

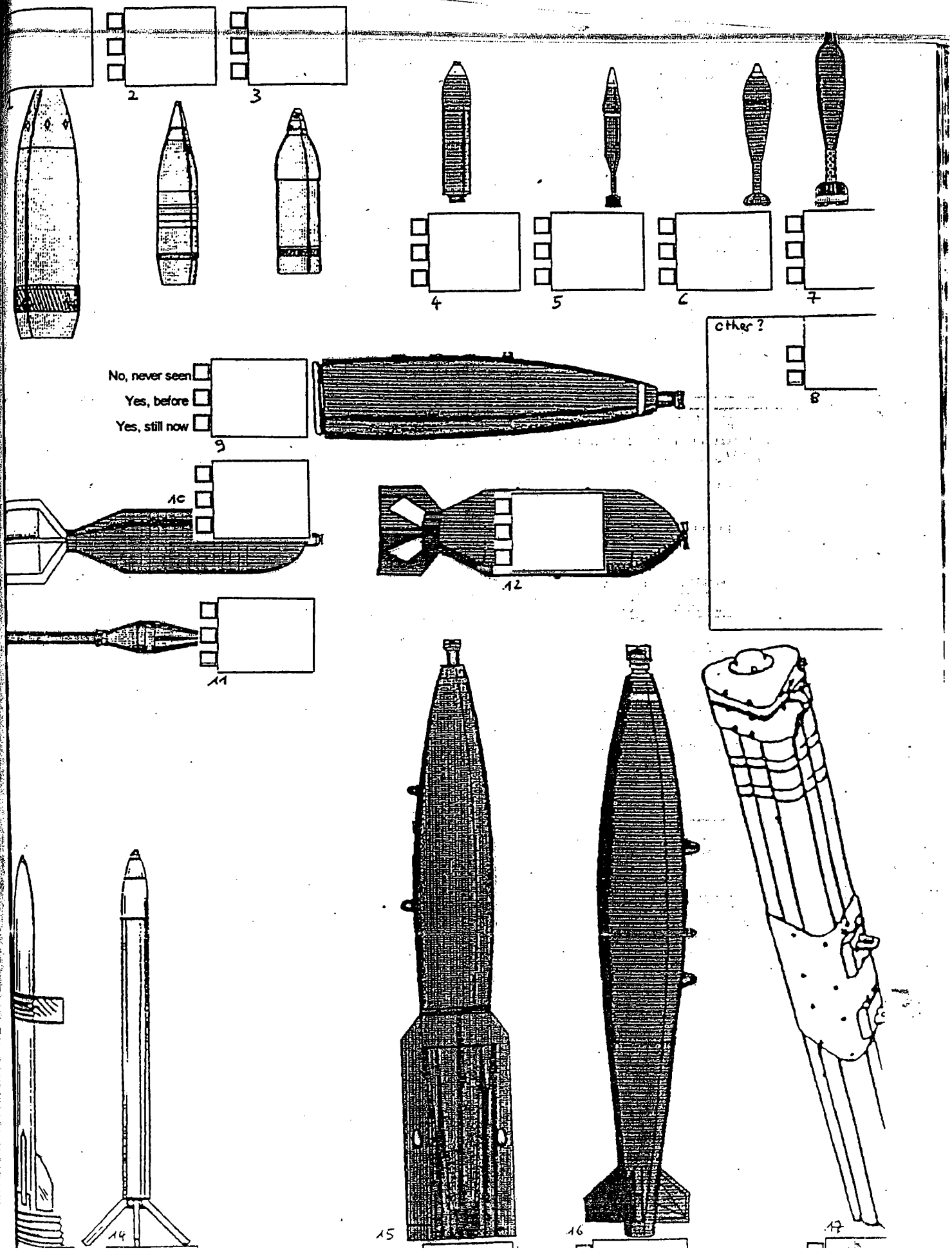
1. Is there at present anybody from outside your commune supporting your commune with a project ? No Yes ➡ Health improvement ☐ Agriculture ☐ Water supply ☐
Road constructure ☐ Education☐ Other☐
Who are they ? : Government ☐ NGO ☐
Name of Organization:

Box 16 - to be filled by data-collector and survey management group.

	DD/MM/YY	Name	Signature
Interviewee			
Interviewer			
Supervisor 1			
Supervisor 2			
Data inputer			
Data analyser			

Have you ever seen this kind of UXO or mine in your commune ?




1
2
3
4
5
6
7
8
other ?
No, never seen
Yes, before
Yes, still now
9
10
11
12
14
15
16
17

Appendix 3 - Questionaire 2

ACCIDENT FORM

Box 1 - to be filled by data collector

Victim name: **Age:** **Sex:**	**Commune name:**	**Commune code:**
District:	**Province:**	**Interviewer name :** **Signature**

Box 2 - to be filled by data collector

When did the accident happen ?

Day	Month	Year

Box 3 - to be filled by data collector

Are you victim ?

Yes

No ➡ a. What relationship did/do you have with the victim?:

husband, wife ☐ Sister/brother ☐ Parent ☐ Cousin ☐

Uncle/autine ☐ Friend ☐ Other ☐

b. Did the victim die ?

No ➡ Where is the victim now :

Có ➡ How long after

Immediately ☐

After sometime :

hour	day	month	year

Box 4 - to be filled by data-collector

1. How old was the victim at the time of the accident? :
2. Was the victim living in the commune ? : Yes No ➡ which commune :
3. Did the victim get the accident in the commune ? : Yes No ➡ where:
4. Was the victim maried at the time of the accident ? : No Yes ➡ How long :
5. If not die, is the victim maried now ? : No Yes
6. Did the victim have any children at the time of the accident ? : No Yes ➡ How many :
7. The victim's occupation before the accident:
8. The victim's occupation after the accident :

Box 5 - to be filled by data-collector

What kind of injury was it ?

Amputation	Arm	Forearm	Hand	Finger	Thigh	Shank	Foot	Toe
Right								
Left								
Paralysis	1 arm	2 arm	1 leg	2 legs	1/2 body	All body	Other:	
Burn	Face	upper limb	Chest	Lower limb	All body	Other:		
Wounds	Face	upper limb	Chest	Lower limb	All body	Other:		
Blind	1 eye		2 eyes		Other:			
Deaf	Slight		medium		Serious		Vrey serious	

Box 6 - to be filled by data-collector

What did the victim do after the accident for treatment ?

Nothing	Went to neighbourhood	Other
Treated him/herself	Went to commune clinic	Any surgery ?
Went to the wat or monks	Went to health center	No Yes
Went to traditional doctor	went to province hospital	? times :

Box 7 - to be filled by data-collector

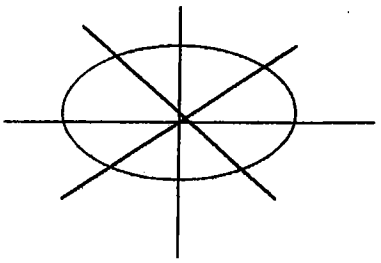
1. Did the accident happen in the commune ? No ➡ which commune ? :
Yes

2. In what kind of place did the accident happen ?

commune	road	land field	Grazzing land	near or in forest	Other:

3. From here, where exactly the accident happened :

Ask the direction and estimated distance in kilometre from commune center.



Box 8 - to be filled by data-collector

What was the victim doing when the accident happened ?

Dicking for: rice field☐ Well☐ Housing☐ Catch insect☐ Other☐
Burning for: rice field☐ cooking☐ gabage☐ Destroy UXO☐
Cutting for: tree☐ grass☐ grow animal☐ other☐
Touch to UXO:
removing, throwing☐ defusing it☐ Opening ☐ play it☐
Do nothing, touch to UXO suddenly☐

Box 9 - to be filled by data-collector

1. What kind of UXO /mine was it ?: Bombi☐ Big Bomb☐ Grenade☐ Mine☐ Don't know☐
2. Did the person know that there was UXO/mine in this place ? Yes No
3. Did the person know the danger of UXO/mine ? Yes No

Box 10 - to be filled by data-collector

Has this place ever been cleared before ? Yes No Don't know
If Yes, ➡ Who cleared it ?:

Box 11 - to be filled by data-collector

Was there any one else injured or killed during the same explosion ?
No Yes ➡ How many persons ? :

Men:	Women:	Children:

If possible, give name of those persons :

1	2	3	4
5	6	7	8
9	10	11	12

Box 12 - to be filled by data-collector and survey management group.

	DD/MM/YY	Name	Signature
Interviewee			
Interviewer			
Supervisor 1			
Supervisor 2			
Data inputer			
Data analyser			

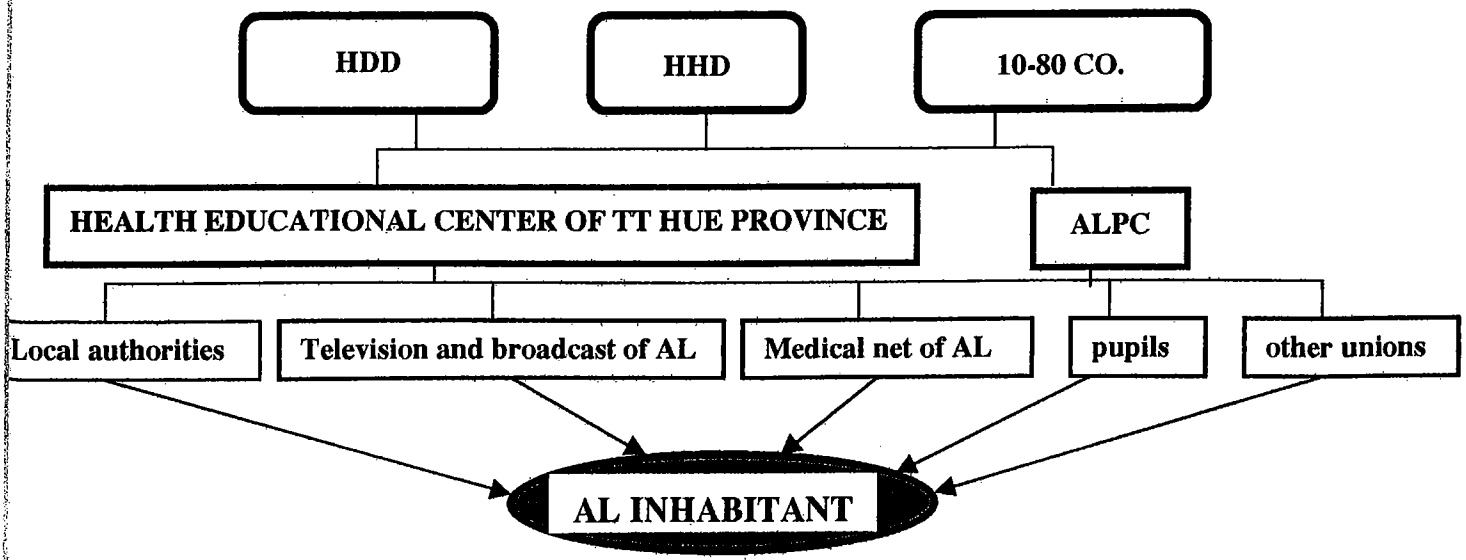
DOCUMENT

UXO AWARENESS EDUCATION PROGRAM (UAEP)

The longterm impacts and risks of UXO to human health and socio-economic are very evidently. Now, the Government and N.G.O and humanniterian organization on the world are doing in the best effort to support for UXO clearance operation in the post-war countries or war countries. This working has power-means to give back cleared area for inhabitant doing agriculture, housing...so, it has participated not a small apart of socio-economical development.

A Luoi now is not only suffered from the long-term impacts of chemical warfair but also suffered from the risks of UXO seriously. Because of the increase of UXO, A Luoi need to get the UXO clearing operation as soon as possible. However, the UXO clearing operation will neither spend long time nor spend a large budget. So, while we are waiting for the condition to do this operation, we should carry out an indispensable UXO awareness education program for A Luoi inhabitant. By this education program, the A Luoi inhabitant will know how they should do to protect themself from UXO's risks.

THE ORGANIZATION OF UXO AWARENESS EDUCATION PROGRAM



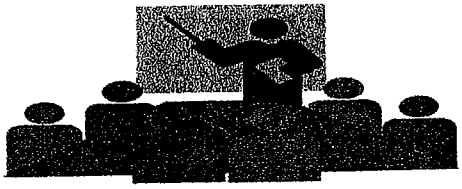
FORM AND CONTENTS OF THE UXO AWARENESS EDUCATION PROGRAM

I. Operate some trainning courses :

1. Contents : UXO - risks and preventing ways
The first medical aid for a UXO's victim

2. Subjects get the trainning courses:
Local authorities, the unions of district and commune such as : veterans, medical, youth, school pupil, women, television and broadcast, ... Those subjects will tranfer the information to inhabitant.

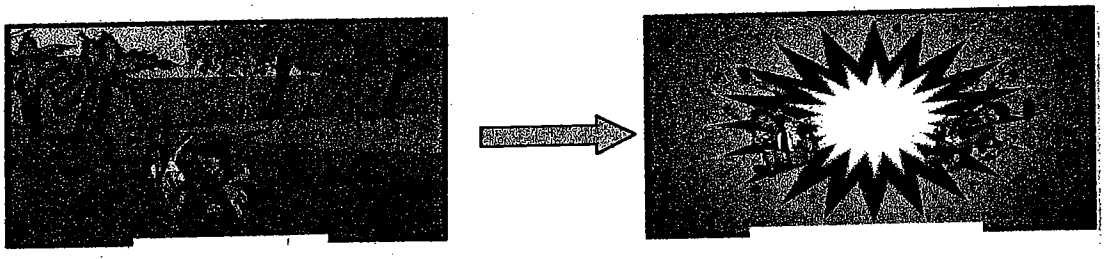
The trainning course will provide to Al inhabitant the basis UXO awareness and how they should do when they see UXO and face on a UXO accident.



II. Produce the UXO awareness pictorial book :

1. Content : What they should do or should not do when seeing UXO.

Example



2. Subjects received this book :
All the school pupil in A Luoi valley will received this book and bring it to families seeing.

This pictorial book will be contributed as the pictorial stories, so the pupil will be easy to get the contents in their minds.

III. Produce the UXO awareness posters :

1. Content : To propagate the riks of UXO and some preventing ways

Example

2. Subjects receive this contents are all AL inhabitant

These above posters will be sticked on the wall of every public place such as clinic, commune committee, post office, the village's meeting room, markets, etc...Especially in the areas where are contaminated by UXO.

IV. Produce a UXO awareness video tape and a cassette tape:

1Contents : Propagate to A Luoi inhabitant about the contaminated area and how should they do when seeing UXO.

2. Subjects receive this content are all A Luoi inhabitant

Those tapes will be provided to AL district and communes, and the district's and commune's television & broadcast will deliver to all A L inhabitant in every monthly program.

V. Produce the UXO awareness bill board in A So base area:

1. Contents : The risks of UXO and the prohibiting of human activities in contaminated site.

2. Subjects receive this content are A So inhabitant

Appendix A7

Results of UXO Presence and Victims Surveys in Aluoi District (directly translated from Vietnamese to English in Ha Noi, Viet Nam)

ALUOI – THUA THIEN HUE
LIVING WITH UXO

RESULTS OF THE SURVEY OF UXO IMPACTS ON SOCIO-ECONOMIC AND HUMAN HEALTH IN ALUOI VALLEY, THUA THIEN HUE PROVINCE

2001

Report by

10-80 Committee, Viet Nam
Hue Health Department
Hatfield Consultants Ltd., Vancouver, Canada

Supported by

Canadian International Development Agency (CIDA)

FORWARD

During the second Indochina War, the American Forces carried our two wars that destroyed human health and ecosystems of Viet Nam: the hot war with weapons like bombs, mines, artillery, and the chemical war with chemicals like Agent Orange, Agent Blue, and Agent White. Those weapons have long-term impacts to human health and ecosystems of Viet Nam decades after the war.

Since 1980, Viet Nam National Committee for Investigations of the Consequences of chemicals used during the Viet Nam War (10-80 Committee) has co-operated with many up-country organizations and international organizations to investigate the long-term impacts of the chemical war on human health and ecosystems in Viet Nam. Areas that were sprayed with herbicides were not only contaminated with dioxin, but also contaminated with unexploded ordinance (UXO). UXO has caused many accidents to inhabitants, and limiting the local socio-economic development.

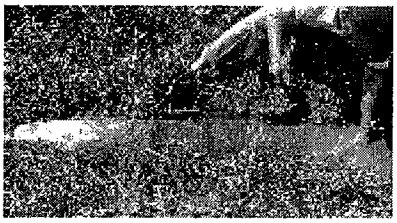
From 1994 to 2000, 10-80 Committee and Hue Health Department had co-operated with Hatfield Consultants Ltd. (HCL), Vancouver, Canada to carry out a dioxin assessment program in Aluoi Valley, Thua Thien Hue Province. After obtaining results of the dioxin investigation, they have produced strategic plans mitigating the dioxin contamination in the environment of Aluoi Valley. However, Aluoi is seriously contaminated with UXO. Therefore, we have to solve the UXO problem in advance of solving dioxin contamination in this area.

The 10-80 Committee and Hue Health Department with the support of HCL and CIDA (Canada) implemented the UXO presence and UXO accident survey in Aluoi Valley in 2001. Results of the survey would show us the long-term impacts of UXO to human and socio-economic development in Aluoi Valley. We hope that this information will be useful for inland or international organizations which have or will have projects in there like the UXO mitigation project, rural agriculture development project, infrastructure development project.

10-80 Committee Chairman

Prof. Hoang Dinh Cau

ALUOI – THUA THIEN HUE
LIVING WITH UXO



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10-80 Committee Chairman

Prof. Hoang Dinh Cau

An A Luoi inhabitant with the demining equipment made by himself had an UXO accident – amputation one time.

CHAPTER I

BACKGROUND

A. A BRIEF HISTORY AND GEOGRAPHY OF THE WAR IN A LUOI

B. THE SURVEY METHODOLOGIES

1. The purpose of the survey
2. The survey method
3. Data structure

C. UNEXPLODED ORDINANCE

1. Reasons why ordnance does not explode
2. Types of unexploded ordnance

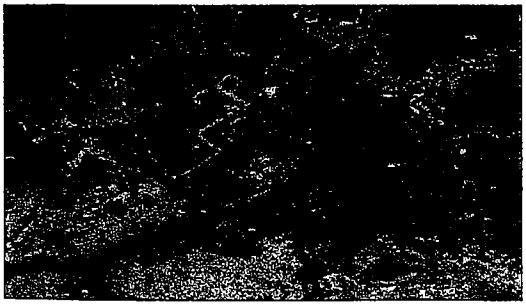
A. A BRIEF HISTORY AND GEOGRAPHY OF A LUOI VALLEY

Before 1960, A Luoi was a moutain area with the tropical rich forest ecosytem, and had abudant botany and animal systems. Inhabitants thinly resided with a few tribes like Paco, Pahy, Ca tu, Ta oi.

Regarding to the geography of A Luoi, A Luoi is divided into two main valleys that is A So valley – South of A Luoi and is A Luoi valley – North of A Luoi. Those valley added up to A Luoi District. A Luoi is in 116-116,37 North latitude and 107-107,36 East latitude (as follow the UTM co-odinated system), and it is lied along the Truong Son chains. Its West-North bodered with Huong Hoa District, Its South bodered with Lao PDR, and far away from West of Hue is 65 kms.

The natural area of A Luoi is 116,642 Ha. The A Luoi length is 30 km, and its wide is 3 km. A Luoi is surrounded by mountains that has height from 700 – 1000 m, and the average height of A Luoi with sea face is 600 m. Almost of A Luoi mountains has slope > 15 °.

Hue was viewed through Landsat immagery in the year 2000.



A Luoi was viewed through Lansat immagery - 2000

Because the A Luoi lies along the Truong Son chains and is " the tight knot area" between South and North of Viet Nam, the A Luoi was an army strategical area not only for American-South force but also for Viet Nam North troops during the war. With the American-South force this area was very important to use for stoping the North troops entered to South VN, and as for VN North troops this area had to be liberated in order to use for entering to South VN. That why the A Luoi valley could not be no sprayed chemical and bomb with the American-South force, and could not be short of the Truong Son chains for the North troops.

As A Luoi was an army strategical area like above description, the American force had set up many important army bases in there since 1958 like A So airbase, Ta Bat airbase, A Luoi airbase, army stations, helicopter airbases ...In addition, the American force used a large amount of toxic chemical and bombs, mine, artilery in order to block entering ways of North troops. The A Luoi valley was liberated in 1967 by North troops after many blood-stained battles between both of sides, with some areas were gone down in history like Humbuger hill, Blood stream,... After A Luoi was lost, the American force frenziedly spray toxic chemicals and bombs in order to eliminate this area. The top of those frenzied war activities was in 1968, 1969, and was stoped in 1973 as following the stoped hostility agreement bet ween North and South of Viet Nam.

Since 1973, A Luoi inhabitants who hided in Lao area during the war, now went back to live in A Luoi. In addition, a part of Kinh people came from flat areas like Hue, Quang Binh, some areas in North VN also went to A Luoi valley in order to fix resident and settled agriculture. A Luoi has been divided into 20 communes and one town. The apperances of the A Luoi has been changed step by step. Almost of inhabitants now have stable life with settleed resident and agriculture and infrastructures has also been developed. However, the post-impacts of war like Dioxin and UXO contamination still be the big reasons effecting to A Luoi human health, limiting agricultural activities and infrastructure development.

A Luoi inhabitants

B. SURVEY METHODOLOGIES

1. The purposes of the UXO survey:

The purposes of the survey are to collect information not only for UXO situation but for impacts of UXO with human health, socio-economic development in A Luoi valley, Thua Thien Hue Province that is a hot area during the war. Base on those information, we would be able to make all-sided plans for UXO mitigation working in A Luoi valley and participated into the tasks solving post-impacts of the war of Viet Nam country.

Before implementing this survey, there was not any report of Government, organization, person, N.G.O...reported about the UXO situation and its long-term impacts on human and other aspects. Therefore this survey will be the first cmprehensive survey of UXO in one area of Viet Nam – A Luoi valley. The results of this survey will be a product of qualitative information intergrated quantitative information of the survey. In this reports, we will not separate the qualitative results and quantitative results. Those data will be sorted alternately.

Qualitative results

Qualitative results provide us an overall view about the UXO situation, the difficulties of the data collecting, and help us to asses the accuracies of the quatitative results. The qualitative results were collected by interviewing with some organizations that can provide us information related UXO, are Defence Ministry, Army engineer headquarters, Technology Center for Bomb and Mines demining, Local People Committee, Veteran Association, Agriculture and rural development Department, old-inhabitants, ... One part of those information were actually collected through the survey of 10-80 Committee and HCL through 1994-2000, and the other parts were collected in half og 2001.

Quantitative results

Quantitative results provide us more accurated and detail information than the qualitative results by the direct interviewing with every interviewee. There were two kinds of questionaires used to collect those data in every commune of A Luoi valley. Those questionaires were designed base on the experiences of the UXO survey in Lao PDR in 1997 that was carried out by Handicap International Organization.

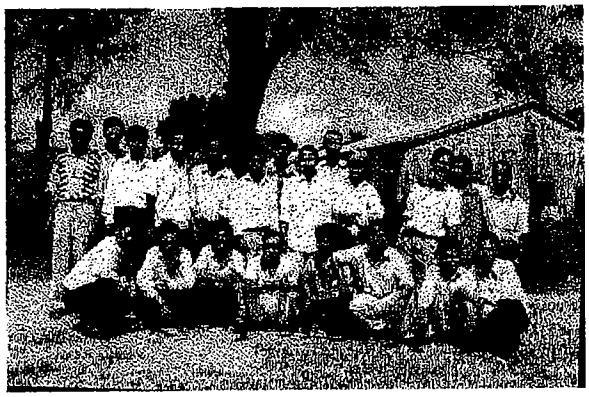
UXO Commune forms – 2001, was used to collect data as below:

The presented UXO contamination and which areas are remained UXO in A Luoi valley. The questionaires also provide us the data of conflicted areas during the war, attitude of inhabitant to UXO, limitation of agricultural activities, limitation of socio-economic development,...(see annex I).

UXO Accident forms - 2001, was used to collect data as below :

The age and gender of the victim; the location of the accident; the activity during the accident; the types of UXO involved; if know, the oucome of the accident (death or types of injuries); and the socio-economic status of surviving victims. The accident interviews were conducted following the completion of the commune questionaires. The victim was interviewed if still living, otherwise a close relative provided the information. Accident data were cross-checked to prevent duplicate records of a single UXO-related accident, as well as to minimise errors based on oral history. The accidents data constitutes a district record of UXO-related accidents which have occurred since 1973. The accident report form can be found in annex II.

The interviewer group of UXO accident survey



The interviewer group of UXO survey

2. Survey method

Survey coverage

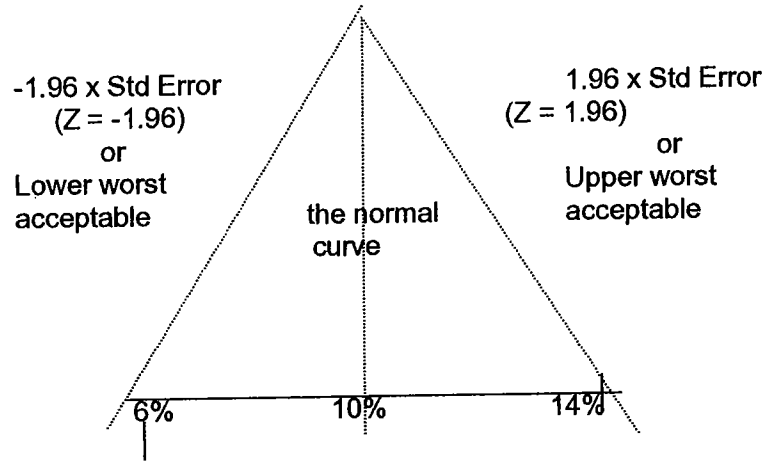
- Following a review of the history and geography of the A Luoi during the war, survey teams visited 20 communes and 1 town of A Luoi valley because it was reported that almost of areas in A Luoi valley had been major ground battles or aerial bombardment during the war period. Significant contamination by UXO was reported in almost communes of A Luoi valley.

- Sample size of the survey :

  . Sample size representative for UXO survey in A Luoi :

A Luoi population :	37.000
Expected frequency of the factor under study:	10%
Wrost acceptable results:	6%

Estimated sample size



$$S = Z^*Z\,[P(1-P)]/(D^*D)$$

Sample size = S/[1+(S/population)]

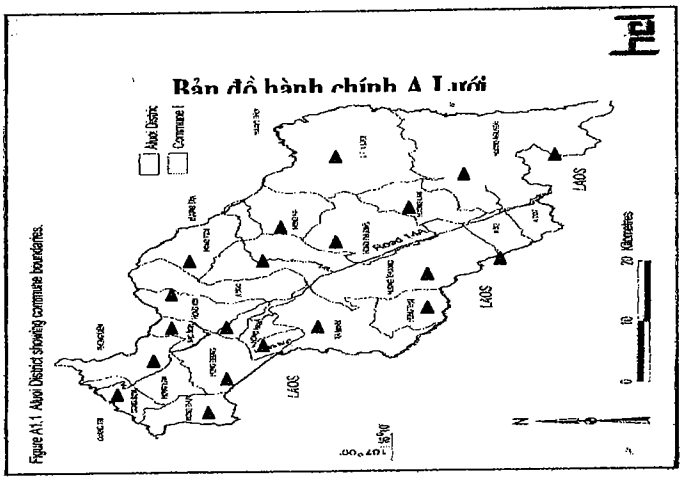
(Kish & Leslie, Survey sampling, John Wiley & Sons, NY, 1965)

Confidence level	Sample size
80%	92
90%	152
95%	215
99%	369
99.9%	599
99.99%	832

. The interviewees of the UXO survey are original inhabitant living in A Luoi since the war to now, prior to interviewee are veterans. The survey teams visited every interviewee in their family. The number of interviewees of one commune is 100 people, so the total people were interviewed to be people. During the survey, Nham commune was not involeved the survey. That why the total interviewees are 2.000 people.

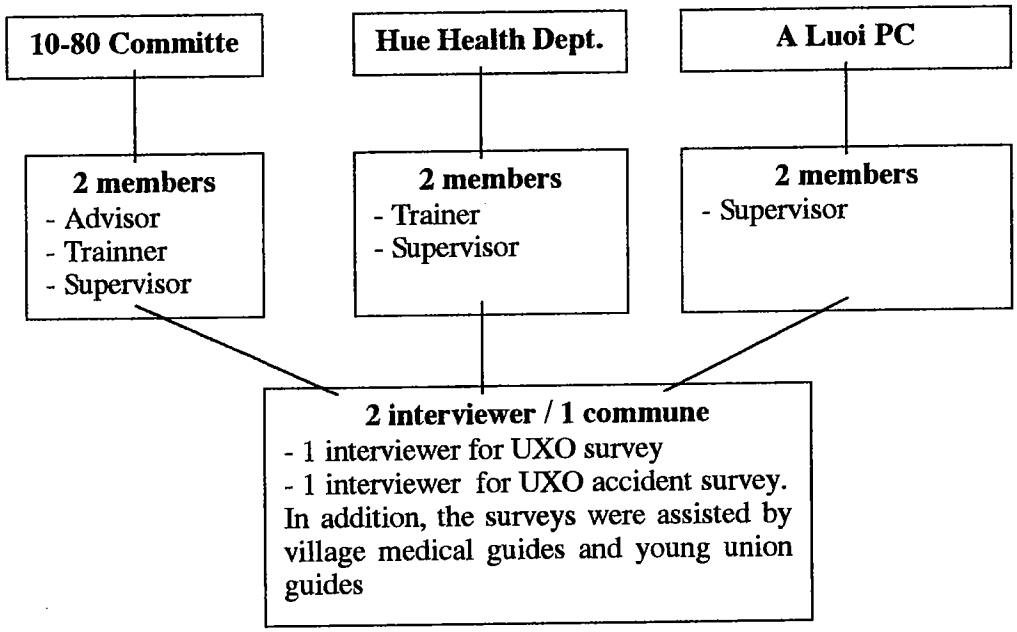
. The interviewee for UXO accident survey are UXO victim, or their families and their neighborhood if they died. All of victim involved the survey were got accident after 1973.

Survey coverage in A Luoi valley.



Human resources

10-80 Committee designed method, plans and questionaires of the survey, and collected qualitative data. Then co-ordinated with Hue Health Department and A Luoi People Committee implementing the survey.



The interviewers were collected as follow the ways:

- For UXO survey: the interviewers were collected from defence organization or young union of the communes.
- For UXO accident survey: The interviewers were collected from health station of the communes.

Implemented plans

The survey's plans were summarized as below :

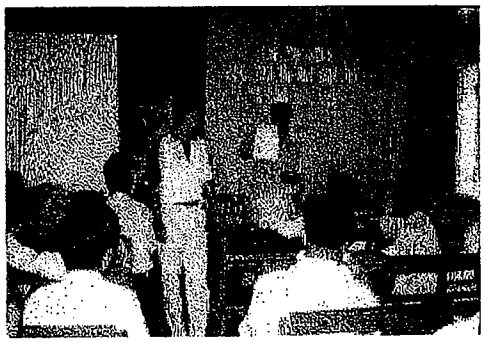
1. Designed plans and questionaires for the survey.
2. Make a detail plans for the survey.
3. Training for interviewer, and interviewer implemented the survey.
4. Supervising the survey.
5. Checked and took over the filled questionaires.
6. Input data, analyze data and produce the final reports.

Actually, Hue Health Department already carried out the UXO accident survey in May, 2001 with the assistances of village medical guides. We considered the results from the May survey of HHD as the primary results for the UXO accident survey in A Luoi valley. However, in order to get the accurated results, we collected all of the filled questionaires got an accident after 1973, then carried out the survey again with every object.

The schedule of the survey

program	May	Jun	July	August	September
UXO accident survey by HHD	▬				
Training for interviewers.		▬			
Implementing the survey II			▬		
Input data			▬	▬	
Analyze data and produce the final report.					▬

The UXO survey training class in A Luoi hospital.



3. Data structure

The data that were collected by the survey would be coded and inputed into computer by the EPI INFO 6.0 or SPSS 9.0 program. Those data would be analyzed, then intergrated with qualitative data, GIS, satellite immagery pictures, ...Finally, the final reports will be produced by 10-80 Committee, Hue Health Department and Hatfield Consultant Co.Ltd.

Maps

An important outcome of the survey was development of a Geographic Information System (GIS) to support the mapping and database management requirements of UXO mitigated organizations.

A database was created containing the following of each commune, the exact Vietnamese names. Those commune database would be converted to digital map data and linked to the satellite immagery pictures by HCL.

The collected data would be analyzed as follow some main information, as below:

1. The contaminated map of every commune of A Luoi
2. Locations of UXO contamination
3. Types of UXO
4. UXO related accidents
   - Types of UXO related accidents and Types of injuries
   - Activities related accidents
   - Hospital and local clinic coverage for victims
   - Treatment and support for victims
5. Awareness atitude of inhabitant to UXO
   - Acting of Inhabitants when seeing UXO
   - Children with UXO
   - Known of inhabitants with awareness of UXO
6. Phân tích tác hại do UXO gây ra đối với kinh tế - xã hội tai địa phương
   - Community impacts of UXO
   - Difficults of families have UXO victims
   - Economic impacts of UXO
   - Atitude of communities to UXO victims
   - Limited of agriculture activities by UXO
   - Land use with UXO
   - Resettlement of inhabitants with UXO
   - Impacts of irrigation schemes
   - Impacts of UXO with road construction
   - Plans of local organization to UXO solving
7. Other information related UXO.

C. Unexploded Ordnance (UXO)

1. Reasons why does not detonate

Base on information gathered from VN Defence Ministry, it is estimated that up to 5 percent of more than 15.350.000 tons of ordnance dropped on Viet Nam did not exploded as planned. During any war there is a lot of conffusion, with numerous mechanical and human factors which result in post-war contamination by UXO and landmines. The designer and user of these munitions counted on them to function properly and used high quality, durable materials in their manufacturing process. Certainly, over a 25 year period some of these minitions have become unstable with action of rain, acidlic soils and other natural forces. However, these munitions have explosive content and fuses that can still function under the right conditions, even 25 years later.

Munitions left on the filed of battle

During a conflic, one of the main objectives of bombing campaigns was to destroy ammunition convoys and munitions dumps. Numerous bombing strikes were successful, resulting in the detonation of munitions and the dispersal of munitions an many directions. These munitions would become unstable, some armed and generally in an unpredictable condition. Munitions were also commonly abandoned on the battlefield for many reasons: soldiers running away, being killed and the locations of munitions caches being forgotten or overrun by enemy forces.

Human error

Training can also be a factor in the improper use of weapons and munitions. Generally, inwar soldiers receive little training before deployemnt and in some cases, fire the weapons for the first time in combat. Fear, confussion, fatigue and other destabilising factors can cause soldiers to forget correct weapons handling techniques. Munitions will then be improperly fused or armed and fail to detonate. Different types of ordnance have differing types of arming mechanisms and delivery methods. Some types of ordnance will not detonate unless fired or dropped under the proper conditions.

For example, a bomb that is designed to arm at a certain velocity of spin might not detonate if it is dropped too low to the ground, because it never reached that velocity. A Bomb may have been dropped too low to the ground due to bad weather conditions or human error. Factors such as temperature, water, the sofness of the landing ground and the angle of impact all influence detonation. During the wet season, the ground may have been soft or there may have been standing water which interfered with the detonation of the bomb.

Manufacturing defects

Defects during manufacture will account for an undeterminated percentage of failures in the functioning of UXO. Sophiticated fuse types have a higher rate of failure due to their complexity. For example, delay action fuses are designed to detonate milliseconds after impact to achieve maximum penetration of the ground and destroy bunker complexes. Delay fuses, which are intended to function hours or even days after impact in order to create disruption and confusion, may fail to detonate due to the tremendous forces exerted on the warhead during impact. There is also evidence that some of the ordnance droppoed in Viet Nam were experimental or were deployed to use up old weapon stockpiles and were thus more prone to failure.

2. Types of unexploded ordnance

Difference between UXO and mines

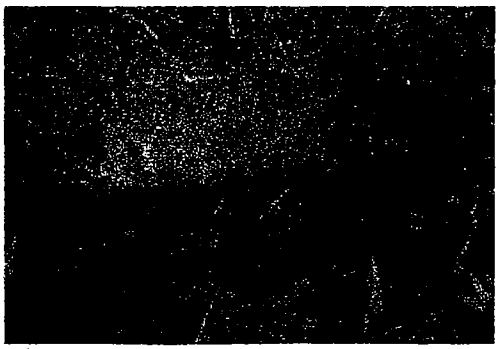
Mines are specifically designed to be placed by hand or remotely (air-dropped or projectile) and lie in wait for the actions of a specified target (person or vehicle) to trigger the firing mechanism. For example, pressure from someone stepping on it, from the weight of a vehicle or movement of the trip wire by someone striking or walking through the wire. In constrast, a UXO it's a munition that has failed to function according to its intended purpose.

Air delivered ordnance

The aerial bombardment of Viet Nam resulted in widespread, severe contamination of large areas of land. Air-delivered ordnance include the small anti-personel and anti-material submunitions (bombies) which are cluster type bomblets dispersed from large bomb dispensers. These were designed for large area coverage.

Air-delivered bombs also included the general purpose (GP) large bombs which vary in size from 100 kilograms to 1.000 kilograms. These were designed to destroy strategic targets such as roads, bridges and military facilities. Air delivered ordnance also included incendiary bombs like napalm and phosphorous, as well as smoke bombs, and certain types of landmines.

A 1.000 kilograms bomb was found in Hong Kim commune, A Luoi



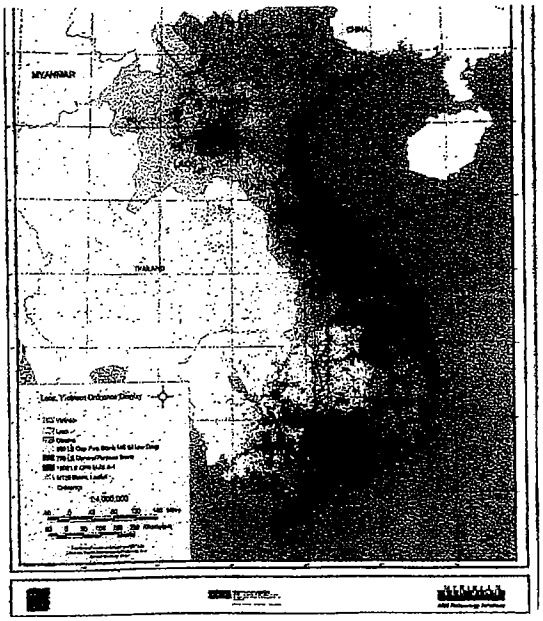
Ground delivered ordnance

Ground battles used weapon systems with munitions designed to produce special effects such as anti-tank, anti-personel, anti-material, smoke, incendiary or to illuminate the battlefield. Ground battles also involved the use of hand grenades which can be anti-tank, anti-personel, smoke producing, incendiary or to illuminate the battlefield. Military camps and airbases were often defended by the placement of landmines around their perimeters. These were designed to destroy vehicles or inflict casualties on personel who stood on them or drove over the top of them.

An inhabitant in A Luoi valley is demining UXO for metals in his garden.

* The total amount of bombs and marble that American force used in Viet Nam was 15.350.000 tons with density 46 tons/km2 area . It is estimated that there were 280 kg/1 Vietnamese person. It is also estimated that up to 5 percent of more than 15.350.000 tons of ordnance dropped on Viet Nam did not exploded as planned, so there are 350.000 tons of UXO in Viet nam after the war. Those UXO impact atleast 5% land area of Viet Nam (about 1.647.800 ha).

Bombing map of U.S Force in Vietnam



CHAPTER II

RESULTS OF THE SURVEY

A- RESULTS OF THE UXO SURVEY

Total interviewees of the UXO survey were 1.951 people who were divided into age groups and gender groups with abudent standards, occupations like farmers, officers, pupils, veteran ...Nham commune did not involved in this survey.

The interviewers carried out to interview in family of every interviewee, and average time for a questionaire is 22,84'.

Table 1: Number of interviewees as following age and gender-groups.

Age (years)	Male	% Male	Female	% Female
< 10	18	0,9%	5	0,3 %
10 - 20	235	12,0 %	91	4,7 %
21 - 30	413	21,4 %	72	3,7 %
31 - 40	227	11,6 %	49	2,5 %
41 - 50	236	12,0 %	53	2,7 %
51 - 60	219	11,2 %	66	3,4 %
61 - 70	174	9,0 %	25	1,3 %
> 70	56	2,8 %	11	0,5 %
Total	**1.578**	**80,9 %**	**372**	**19,1 %**

The table 1 showed that most of interviewees is male whose age are in working time (80%). Those interviewees often work on the field or forest directly, so they can know about UXO better than female or children. It would make errors to be gone down during the survey.

The number of interviewees who were born before the war are 1.174 people (60%), and were born after the war are 637 people (40%). Regarding to the occupations of the interviewees, 80.45% (1.724) of them are farmers, 0.7% (14) of them are specialist, 1.4% (27) of them are officers, 0.05% (1) – an army soldier, 0.25% (6) – veterans and workers, 9.2% (180) – others.

I. IMPACTS OF UXO TO LANDUSE IN A LUOI VALLEY

1. Have UXO or not in their place ?

Base on the reports of A Luoi People Committee and its unions like veteran, agriculture, ..., most of communes of A Luoi valley has been found UXO. However, there is not any survey about the contamination of UXO in there, so

it is very difficult to estimate the level of UXO contamination in every commune. Especially, in the areas that had army bases like Dong Son, Hong Thuong, Hong Bac, Hong Van, Hong Trung have much more UXO than other areas.

The results of the survey showed that 9.2% (179) of interviewees not seen UXO in their place; 15.3% (301) of interviewees don't know. 75.5% of interviewees answered that they have seen UXO in their place including 1.5% (29) seen a few UXO, 28.7% (559) seen a lot of UXO, and 45.3% (883) seen UXO in everywhere of their place.

Do you see UXO in the area that you are living ?. Distributed communes in A Luoi valley as following the percentage of interviewees who have seen a lot of UXO and UXO in everywhere of their place, we have table 2:

Table 2 : Distributed communes as following the answer : a lot of UXO and UXO in everywhere .

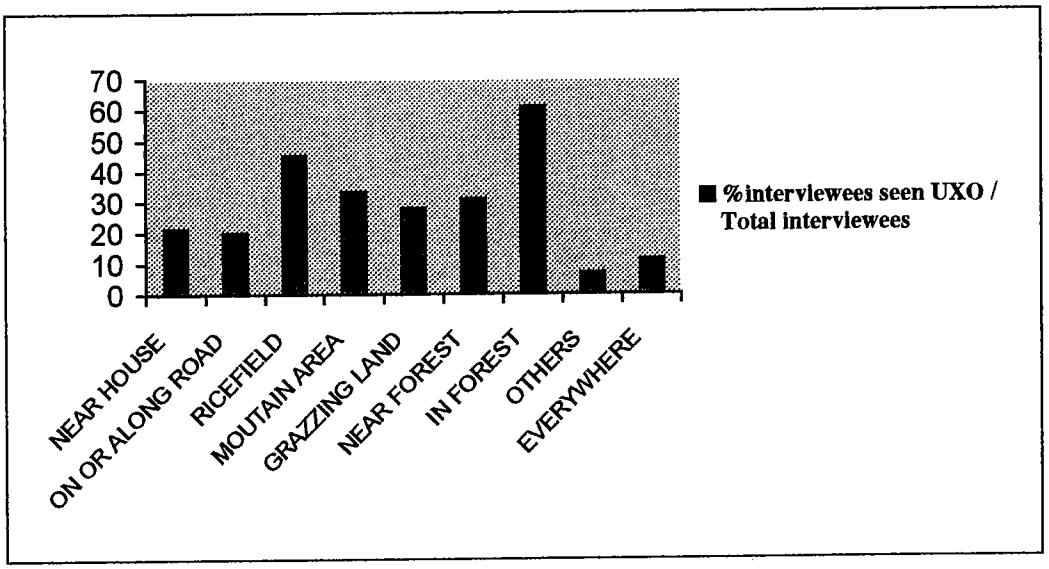
Commune name	Number of aswered people/ total	%	Commune name	Number of aswered people/ total	%	Commune name	Number of aswered people/ total	%
Sơn Thuỷ	98 / 99	99%	A. Ngo	83 / 100	83%	H. Hạ	60 / 100	60%
H. Phong	98 / 100	98%	Bắc Sơn	43 / 53	81%	P. Vinh	59 / 100	59%
T. Trấn	97 / 100	97%	H. Thuỷ	80 / 100	80%	H. Lâm	57 / 100	57%
A. Roàng	86 / 95	90%	H. Quảng	79 / 100	79%	H. Nguyên	54 / 100	54%
H. Kim	88 / 100	88%	H. Vân	72 / 99	73%	H. Bắc	43 / 100	43%
A. Đớt	87 / 100	87%	Đ. Sơn	69 / 100	69%	H. Thượng	35 / 100	35%
H. Trung	86 / 100	86%	H. Thái	68 / 100	68%			

2. Location of UXO

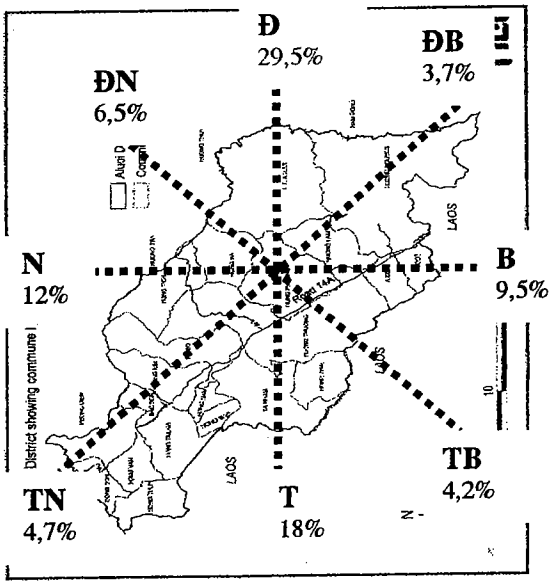
The results of the survey showed that 417/1951 (21.4%) interviewees seen UXO near house in their commune, 388/1951 (20%) seen UXO on or along path of road, 885/1951 (45.4%) seen UXO in ricefiled, 653/1951 (33.5%) seen UXO in moutain area, 544/1951 (28%) seen UXO in grazzing land, 601/1951 (31%) seen UXO in near and 1182/1951 (61%) seen UXO in forest. In uncultivated area, there are 137/1951 interviewees seen UXO. There are 223/1951 (11.4%) answered that they have seen UXO in everywhere.

Chart 1 showed that most of area related to socio-economic, agriculture, forestry, infrastructure development has been contaminated by UXO. Especially, UXO have concentrated in areas that are need for agriculture, forestry and grazzing land. Those contamination have seriously been limiting to socio-economic development and increasing standard of life of A Luoi inhabitant, and make reason's contribution in the reasons of undevelopment and porverty of A Luoi area.

Chart 1 : % of interviewees seen UXO in different area in A Luoi valley.



Regarding the located directions of contaminated areas, the results showed that : 219/1951 (11.9%) unknow directions. The direction with most contamination is East – 576/1951, this direction is to Hue. The West direction bodered with Laos has 356/1951. The South direction bodered with Quang Nam province has 241/1951. The North direction bodered with Quang Tri province has 185/1951. The East-North direction has 73/1951. The East-South direction has 127/1951. The West-North direction has



- 81/1951ng (4,2%). The West-South direction has 91/1951 (4.7%). The annex III will showed the those results in every commune in A Luoi valley.

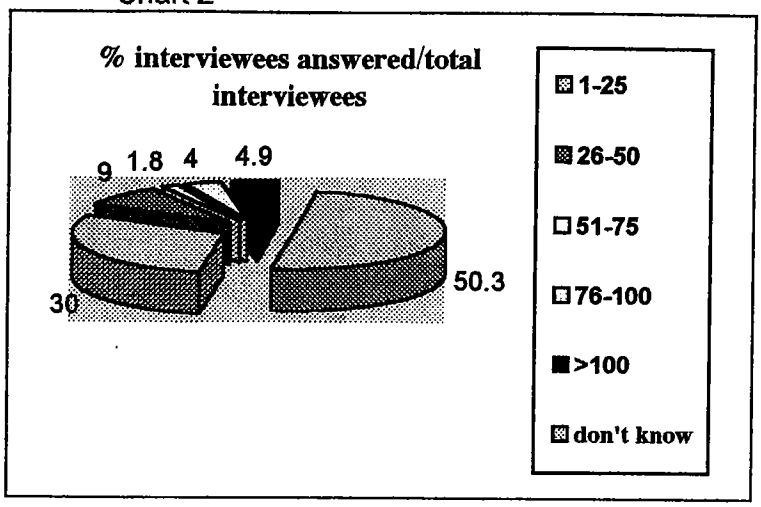
3. UXO with agriculture activities :

The bigest reason that makes limitation of agricultural cultivation is lack of landuse for rice field, cereals field, grazzing activities...especially in moutain areas. In addition, the UXO contamination also make inhabitant who don't dare to cultivate agricuture, even on the rich field that they known. So inhabitant can not produce food for their and their families' life.

Estimated howmany families of your commune have visible UXO/mine on their filed ? – The results showed that :

30% (578/1951) of interviewees answered that there are 1-25 families of their commune visible UXO in their field. 9% (176/1951) answered that there are 25-50 families. 1.8% (36/1951) with 50-75 families. 4% (78/1951) with 75-100 families. 4.9% with >100 families. 50.3% (988/1951) answered that they don't know.

Chart 2



Since the end of war, there are many families who complain with local authorities that they know many places being good for cultivation, but they can not use that land because of UXO. The table 3 showed us that situation.

Table 3 : Area of land that the inhabitant want to use, but can not because of UXO.

Ha	Number of families	%	Ha	Number of families	%	Ha	Number of families	%
0	18	0,9	3-4	15	0,8	7-8	3	0,15
0,1-1	417	21	4-5	38	2	8-9	0	0
1-2	117	6	5-6	5	0,3	9-10	35	1,8
2-3	22	1,1	6-7	4	0,2	unknown	1.277	65.85

In those families, there is 4.5% (87 families/1951) want to use contaminated land for rice field, 2% (39/1951) want to use for grazzing land, 15% (289/1951) want to use for forestry, and 77% (1507/1951) have no answer.

II. UXO WITH RESETTLEMENT

It is difficult to answer the question that is when your commune settled here; however, some of old people can answer that this commune settled here before or after the war. The result is showed in table 4.

Table 4: when the commune settled here

Before the war	**year**	**After the war**	**year**
A Đớt	1959	Hồng Quảng	unknown
A Roàng	1957	Hồng Thái	1975
Bắc Sơn	1955	Hồng Trung	unknown
Đông Sơn	1957	Hương Phong	1975
Hồng Hạ	unknown	Phú Vinh	unknown

Hồng Kim	-	Sơn Thuỷ	-
Hồng Thượng	-	Thị Trấn	-
Hồng Thuỷ	1962	**Most of intervewees don't know**	
Hương Lâm	-	Hồng Bắc và xã Hồng Vân commune	

During the war, almost of A Luoi inhabitant moved to forest area and Lao areas where bodered with A Luoi valley. Some people stayed in A Luoi to become guerillas and local soldiers. There are 629 interviewees/1951 (32%) answered that they lived in A Luoi during the war, and 1322/1951 were not born or didn't live in there during the war.

Now, most of families are living in A Luoi by fixed residence and settled agriculture. The survey showed that 88% of inhabitants lived here by this way, and 12% of inhabitants lived here by shifting cultivation of wandering hilltribes including 100 families in A Dot commune, 53 families in Bac Son commune, 99 families in Son Thuy commune. The most of A Luoi inhabitants fixed residence and settled agriculture, so UXO is really problem with them and they need to be helped for this issue.

III. OTHER INFORMATION RELATED UXO

Was your commune bombed by aircraft during the war ?

It was not answered this question by almost of interviewees. There are some people who lived here during the war, can answer this question. Therefore the answer is not only based on the interviewees but also based on the information from A Luoi veteran who are local soldiers during the war.

Table 5 : number of bombing during the war in commune

Commune	Number of bombing	When begin	When finish
A Đớt	> 50	Don't remember	1973
A Ngo	> 50	-	1973
A Roàng	2 – 5	1960	1973
Bắc Sơn	> 50	1955	1973
Đông Sơn	> 50	1960	1973
Hồng Bắc	> 50	1960	1973
Hồng Hạ	> 50	1960	1973
Hồng Kim	> 50	1970	1973
Hồng Quảng	> 50	1960	1973
Hồng Thái	> 50	1961	1973
Hồng Thượng	> 50	1961	1973
Hồng Thuỷ	6 – 50	Don't remember	1973
Hồng Trung	> 50	1970	1973
Hồng Vân	> 50	1960	1973
Hương Lâm	> 50	1960	1973
Hương Nguyên	> 50	1960	1973
Hương Phong	> 50	Don't remember	1973
Phú Vinh	> 50	-	1973

Sơn Thuỷ	> 50	-	1973
Thị Trấn	> 50	1960	1973

Were there any ground battles in the territory of your commune during the war ?.

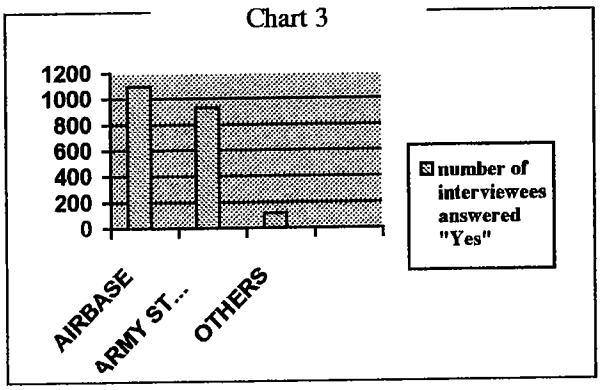
Based on the information of people living here during the war, most areas in A Luoi valley had conflictions between American force and VN troops. The American force setted many army bases in A Luoi valley during the war. The table 6 and chart 3 showed us the result.

Table 6

Commune with >30% interviewees who answered "Yes"			Commune	Number of interviewees answered "Yes" / Total	%
Commune	Number of interviewees answered "Yes" / Total	%	Hồng Bắc	45/100	45%
A Đớt	70/100	70%	Hồng Hạ	67/100	67%
A Ngo	48/100	48%	Hồng Kim	62/100	62%
A Roàng	89/100	89%	Hồng Quảng	50/100	50%
Đông Sơn	96/100	96%	Hồng Thái	87/100	87%
Hồng Thượng	89/100	89%	Hương Lâm	70/100	70%
Hồng Thuỷ	98/100	98%	H. Nguyên	93/100	93%
Hồng Trung	85/100	85%	Thị trấn	66/100	66%
Hồng Vân	88/100	88%			
Commune with <30% interviewees who answered "Yes"					
Bắc Sơn	49/53	Sample size is small.	H. Phong	0/100	0%
			Phú Vinh	10/100	10%
			Sơn Thuỷ	1/100	1%

The results showed that there are 1.096 interviewees who answered there was airbase. 993 answered there was army station, and 113 answered there was others.

Chart 3



Are there any unexploded bombs or bombies (UXO) in your commune ?

85% of interviewees answered "Yes" (1662/1951), "No" and "Don't know" with 289/1951 (14.8%). 19 communes/20communes has the answer – "Yes" with >70% interviewees.

Are there any land mines in your commune ?

59% of interviewees answered "Yes" (1149/1951), "No" and "Don't know" with 802/1951 (41%). 12 communes/20communes has the answer – "Yes" with >70% interviewees.

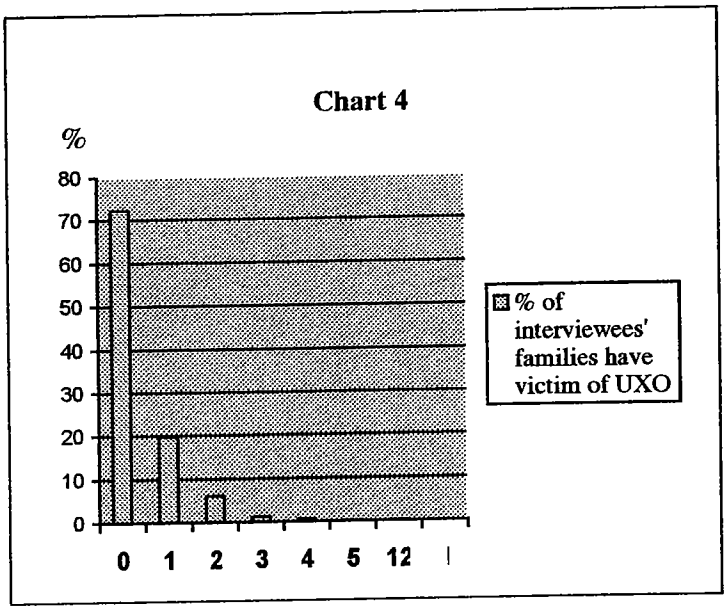
So the result showed that there is 95% of communes of A Luoi which has UXO, and 60% of communes of A Luoi valley has land mines.

IV. UXO AND ACCIDENTS

In the report of UXO survey, we have not given the detail data of UXO accidents. This results will be showed in the report of UXO accident survey. The accident data in this section is only consulted for accuracies of the section B.

There are 541 interviewees' families that have victims of UXO. The result is showed by chart 4.

1.410 interviewees' families – 72.3% have no victim of UXO. 386 (19.8%) families have 1 victim. 118 (6%) families have 2 victims. 22 (3%) families have 3 victims. 12 (0.6%) families have 4 victims. 5 (0.1%) families have 5 victims. Especially, 1 families has 12 victims.



Since the end of the war, howmany people in your commune get injured or die to UXO ? The results is showed in table 7.

Table 7

Male (number of case)	Number and % of interviewees		Female (number of cases)	Number and % of interviewees		Children (number of cases)	Number and % of interviewees	
0	430	22%	0	1.220	62,5%	0	1.303	66,8%
1-10	1.253	64%	1-10	719	37%	1-10	629	32%
11-21	207	10,6%	11-40	12	0,5%	11-23	19	1,2%
22-32	38	2%	So number of male case is two times with female and children. That is fixed with reality that male contact with UXO more than female and children.					
33-43	9	0,5%						
44-<100	14	0,9%						

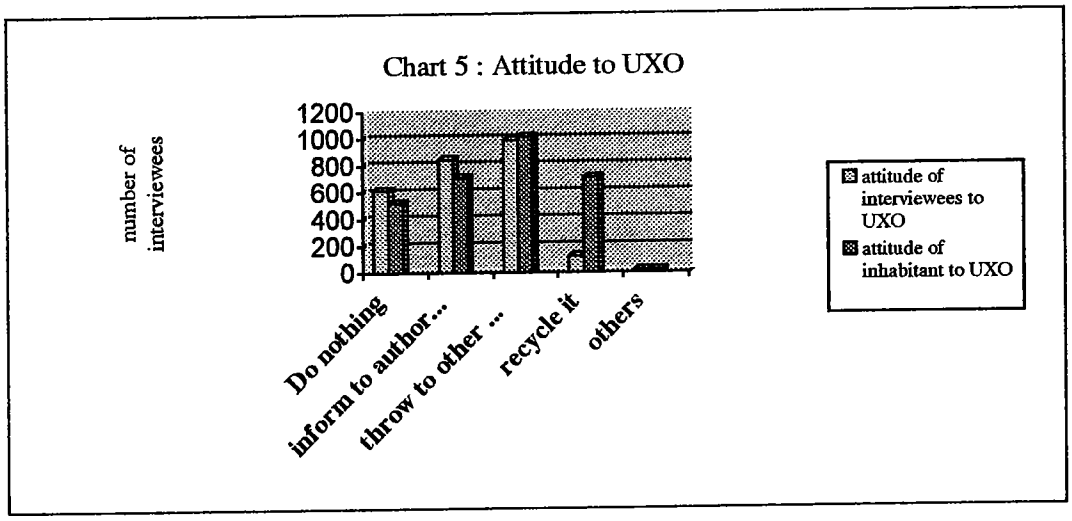
V. INHABITANT'S ATTITUDE TO UXO

What do you do when seeing UXO ?

The answer for this question will showed us the attitude of inhabitants when they see UXO; However, it is often depend on the activities of every people when he or she sees UXO. The survey showed that 986 interviewees/1951 throw to other place, 854/1951 inform to authorities of commune or district, 124 /1951 recycle it, and 20/1951 do others like marking a UXO place, destroying it ...

What have your inhabitant been doing when seeing UXO ?

The answer for this question will showed us the common attitude of inhabitants when they see UXO. The survey showed that 1.014 interviewees/1951 throw to other place, 708/1951 inform to authorities of commune or district, 707 /1951 recycle it, and 521/1951 don't do anything, 18/1951 do others like marking a UXO place, destroying it ...



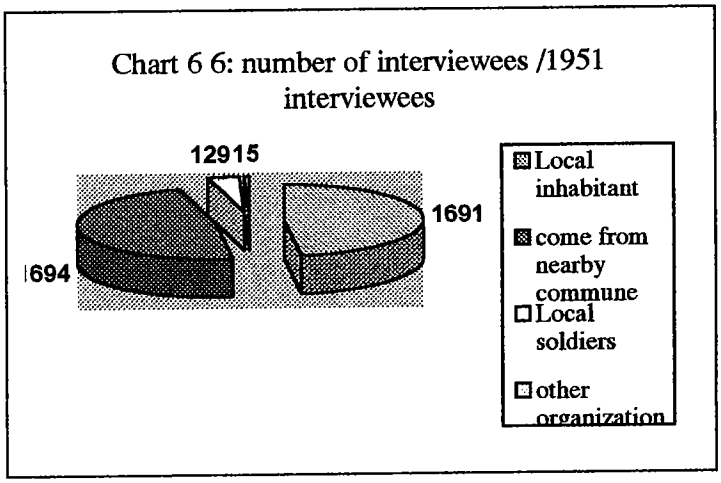
Demining for metal is a common activities of many inhabitants living in A Luoi, and this activity is also a reason that makes a lot of serious accidents by UXO because of the demining equipment of inhabitants is very urdimentary. Otherwise, with a lack of known about UXO, the inhabitant would not know how to treat for every type of UXO that they seen. That why the safety of demining works of inhabitant is "number 0". We had seen and interviewed some of inhabitant deminer, and the same answer is " all of my families' mouth belong on my works like that, so I have to do it earning money even known that is very dangerous".

Have you ever seen people searching for UXO or scrap metal with metal detector ?

90% of interviewees answered that they have seen metal detectors in many places of their commune, and this activity has been done by metal detectors from the end of war to now. It is surprised that most of metal detectors who are local inhabitant and other communes nearby there, but there was a few local organize like soldiers involved this working.

Have you ever seen people searching for UXO or scrap metal with metal detector ?

Who are they ?



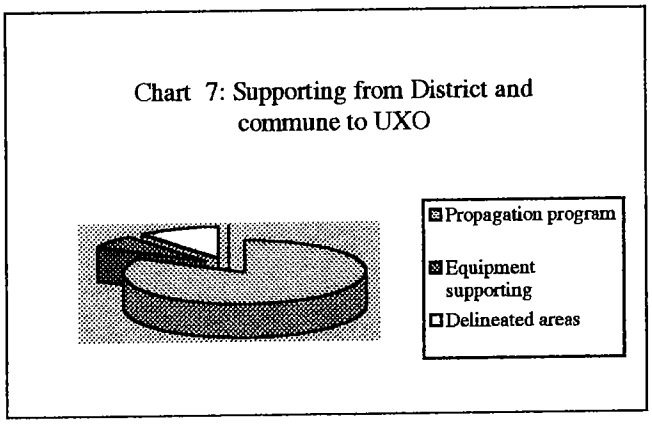
VI. IMPLEMENTING OF LOCAL ORGANIZATION TO UXO

Based on the information collected from local people committee, since the end of the war to now, there is no scale program to solve UXO in A Luoi valley. There was only a few program that was done by co-operation bet ween young union and local soldiers to collect some UXO on the land surface, in order to clear some areas of A Luoi for inhabitant moving back from Lao in 1975, 1976. So the UXO problem in A Luoi valley has nearly not yet been mitigated.

The survey showed that 37% of interviewees (724/1951) know about some small program in 1975, 1976. 63% of interviewees said that they have not seen any program of Province or District to solve this problem in A Luoi valley. But the District People Committee already had some limited activities to decrease accidents by UXO for in habitants like propagation, delineate some contaminated areas,...The chart 7 showed this results.

Are there any supporting from district or commune for UXO's education ?

1.897 interviewees/1951 answered that there were some propagated program about UXO. 147/1951 answered that there were some equipment supporting for inhabitant to UXO. 245/1951 answered that the local people committee delineated some contaminated areas.



Is there at present anybody from outside your commune supporting your commune with a project ?.

There are many projects that is invested in A Luoi area by Government, Province, International Aid, N.G.O in order to cancel poverty and develop socio-economic in A Luoi valley. Actually, A Luoi is important point for canceling poverty program of Government and Province.

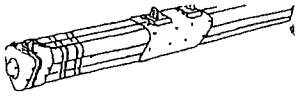
The survey showed that 99% of interviewees (1.921/1951) know about some projects supporting for A Luoi now. Including, 1.076/1951 answered that they known about health projects, 1.674/1.951 known about agriculture projects, 1.535 known about water supply projects, 1.764 known about road construction projects, 1.834 known about education projects, 1.369 known about irrigation projects.

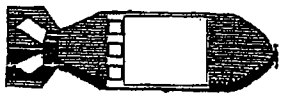
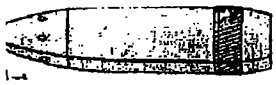
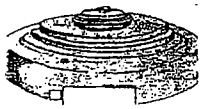
Most of projects supporting for A Luoi are Government's and Province's projects like 133, 135, 327. 97% (1.898/1951) of interviewees known about those projects. In addition, there are many projects supported by N.G.O like VIETAIDS, JVC, World Vision, RIVXI, NAP, ANDO, RVX, SAMIT, UNICEF,...60% (1.179/1951) of interviewees known about those projects.

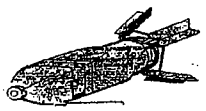
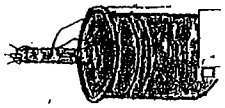
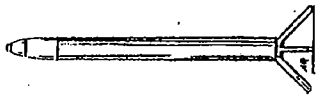
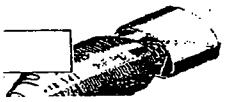
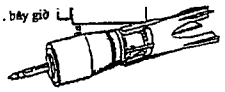
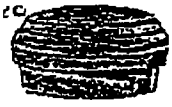
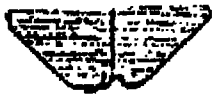
THE RESULTS OF VISUAL SURVEY
HAVE YOU EVERSEEN THIS KIND OF UXO ?

The visual survey helped interviewees to answer the question about the types of UXO contaminated in A Luoi valley easily because the interviewees don't have to remind and describe by them self. This results will showed us the common types of UXO contaminated in A Luoi valley. See table 8.

Table 8: Have you ever seen this kind of UXO
(The data is sorted as folloing the level of percentage of interviewees seen)

UXO you seen				
% of interviewees seen		Type of UXO		Fingure
number	%	N of fingure	Common name	
1.402	72	1 (page1)	Bombi	
1.203	61,7	8 (.1)	Pineapple Bombi	
1.116	57,2	2 (. 2)	Artillery	
1.111	56,9	6 (.2)	Mortar	
1.101	56,4	2 (. 1)	Bombi	
1.034	53	7 (.2)	Mortar	
1.008	51,7	16 (.2)	Big bomb	
1.007	51,6	13 (.1)	Grenade	
927	47,5	3 (.2)	Artillery	
921	47,2	17 (.2)	Rocket platform	
907	46,5	12 (.1)	Grenade	

861	44,1	9 (.2)	Magnetic Bomb	
846	43,4	3 (.1)	Guava Bombi	
830	42,5	12 (.2)	Bacteria Bomb	
773	39,6	5 (.2)	Mortar	
735	37,7	4 (.2)	Mortar	
729	37,4	1 (.2)	Artillery	
722	37	4 (.1)	Bom bi	
717	36,8	5 (.1)	Bom bi	
700	35,9	6 (.1)	Bom bi	
659	33,8	14 (.1)	Grenade	
647	33,2	15 (.1)	Grenade	
598	30,7	21 (.1)	Anti-tank mines	
583	29,9	15 (.2)	Big Bomb	

583	29,9	24 (.1)	Magnetic Bomb	
555	28,4	11 (.2)	B 40	
529	27,1	23 (.1)	Catched mines	
485	24,9	14 (.2)	Rocket	
456	23,4	22 (.1)	Catched mines	
434	22,2	19 (.1)	Chemical Bomb	
370	19	11 (.1)	Phosphoric Bomb	
351	18	10 (.2)	M 79	
329	16,9	10 (.1)	Stepped mines	
302	15,5	9 (.1)	Drilling Bomb	
300	15,4	20 (.1)	Anti-food soldier mine	
283	14,5	17 (.1)	M 14	
274	14	18 (.1)	Butterfly mine	

9	0,5	16 (.1)		Others
4	0,2	8 (.2)		Others

B. RESULTS OF THE UXO-ACCIDENTS SURVEY.

The UXO-accidents survey was implemented by interviewrs who are chiefs of commune clinics under the supervising of A Luoi Health Center, Hue Health Department, 10-80 Committee. Objects of the survey are UXO victims or victims' families if they died, and those accidents have been happened since 1973 in A Luoi valley. Interviwers went to every family seeing and interviewing victims or their families.

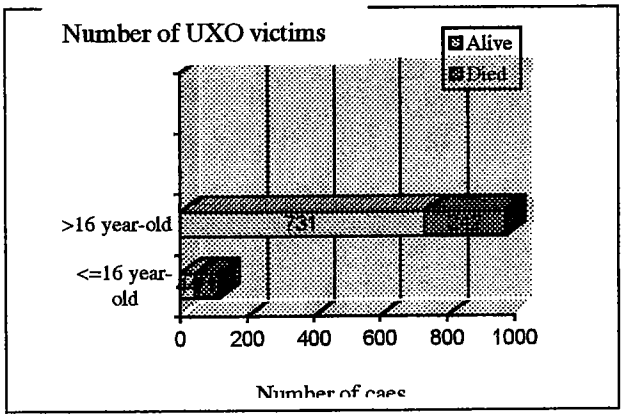
All of interviewers were trained to carry out the survey carefully.

- *View of UXO-accident survey class in A Luoi hospital.*

Total number of UXO victims in A Luoi is 1.088 cases including number of alive victims is 775 cases (71%), and number of died victims is 313 cases (29%). There are 851 male cases (71%), and 237 female cases (22%). The alive children victims who are under 16 year olds has 44 cases, the died children victims who are under 16 year olds has 71 cases. All of cases had accidents after 1973.

Table 1.B : Victims as following age and sex

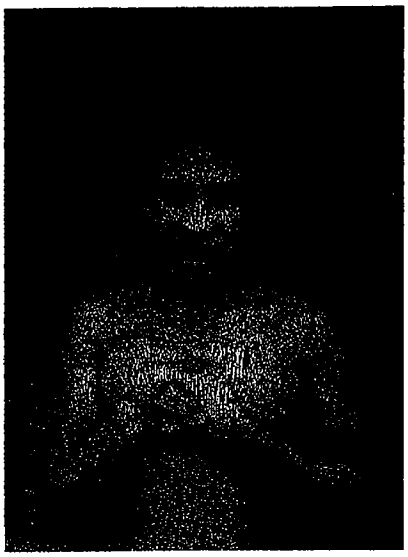
Age	Male	Female	Total
unwriten	44	17	61
1-15 t	83	14	97
>15 - 30	234	36	270
>30 - 45	224	61	285
>45 - 60	163	67	230
> 60 t	103	42	145
Total	851	237	1088



In table 1.B, there are 44 cases with unwriten number of age because of those victims already died, so their families sometime can not remember the victims' age.

The survey showed that almost of victims who are in the working time with 785 cases / 1.088 cases – 72 % of total cases of UXO victims. It is a big ditriment of families and society because victims lost a part or most of working abilities after getting accidents.

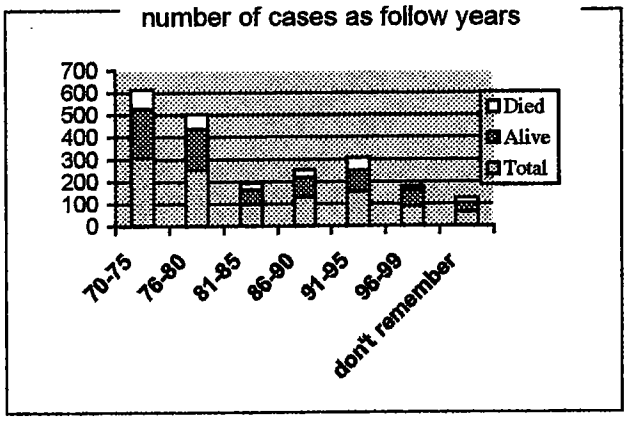
An UXO victim in A Roang commune of A Luoi valley, who had an accident when doing on the rice field, has suffered from losing a right hand, all left fingers, a left eye and dcreasing right eye sight, and still having a lot of pieces of metal in his body.



Almost of UXO accidents was happened in the period 1973-1975. There were 307/1.088 cases in this period, including 125 cases in 1973. As following the information collected from ALPC and inhabitants, A Luoi inhabitants who moved to Lao areas during the war, went back to A Luoi from 1970-1973. At that time the A Luoi People Committee divided up commune's areas and encouraged inhabitant living in here by fixed residence and settled agriculture. Therefore most of UXO accidents was happened in the period 1973-1975. The table 2.B and the chart showed us the results.

Table 2.B : number of cases as follow years

Year	Number of caes		Total
	alive	died	
70-75	222	85	307
76-80	186	66	252
81-85	67	30	97
86-90	91	36	127
91-95	96	58	154
96-99	73	16	89
Don't rem.	40	22	62
Total	775	313	1.088



The table 2.B and the chart showed that the number of UXO accidents' cases has decreased following the years since the end of war in A Luoi. However, the number of cases had increased in the period 1986-1995 that was the time of agriculture development in A Luoi valley. In 2000 and 2001, there was no report of A Luoi hospital related UXO accidents, but that is not mean UXO to be cleared in A Luoi valley. By the recent survey, we recognized that UXO still be a potential risk of accidents because the inhabitant often see UXO on their field, and they have not known about the risks of UXO very well.

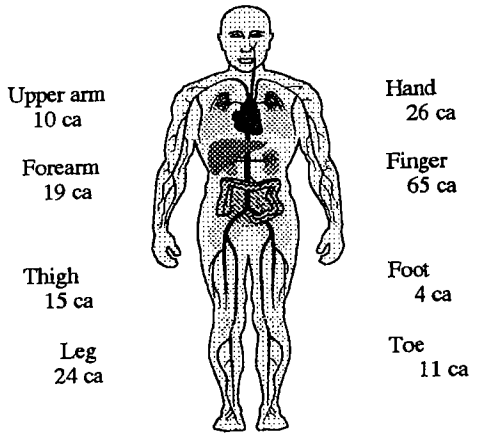
Types of injuries by UXO

The survey showed that there are 1.088 cases who are UXO victims from 1973 – 1999. The number of alive cases is 775 cases, and died cases is 313 cases (including 277 died immediately after accidents, and 36 cases died after sometime).

The number cases of amputation by UXO is 159 cases/775 cases. Those victims have lost working abilities mostly, or apart with the victims who lost hand or fingers. Up to now, there is not any victims with amputation in A Luoi valley who are set up the false hand or leg. Please, should known that almost of those victims are providers of their families. The table 3.B and the figure showed us the results.

Tbale 3.B: The number of amputation cases

Amputation	Left	Right	Both
Upper arm	4	6	10
Forearm	4	15	19
Han	10	16	26
Finger	40	25	65
Thigh	3	12	15
Leg	10	14	24
Foot	1	3	4
Toe	8	3	11



Number of amputation cases by UXO were surveyed in A Luoi valley in 2001.

Out of amputaion injuries, we have seen many different kind of injuries by UXO. Most of injuries caused by UXO are often combined many kind of injuries because many piece of UXO spited out to many directions suddenly with high velocity when it exploded. First of all, there is one kind of injury that we have not canculated is "trauma shock". If the patient was not treated timely, they will be died fastly by this reason. Almost of people have this kind of injury when they get the UXO accidents with the different levels. With the A Luoi capabilities now, there are many UXO victims to be died after accidents because the medical techniciants have a lack of knowledg of trauma schock treatment, and the road from A Luoi to Hue is long so the patients are reached to Province hospital lately.

The results of the survey showed the types of injuries as bellow:

- The total number of paralysis by UXO accidents is 62 cases. Including one arm – 18 cases, two arm – 3 cases, one leg – 10 cases, two legs – 6 cases, a half of body – 5 cases, all of body – 8 cases, unclassified – 12 cases. This kind of injury is not often seen by UXO, but it is very difficult to rehabilitate by any way including medical techniques. Those victims are

also needed to be taken care by families all of time, so it has made unsmall harm for families and society.

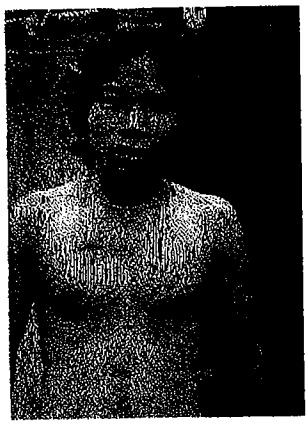
- The total number of burn cases by UXO is 96 cases. Including face burn – 14 cases, upper limb – 36 cases, chest – 9 cases, lower limb – 13 cases, all of body – 4 cases, other positions – 20 cases.

A victim has sticky scars that is sequela of UXO injuries by Phosphorous Bomb.

The burn injury often make the lateeffects for patients seriously such as sticky scars. The sticky scars can cause to unclose eyes, limit movement functions in the position that has injuries, paints...

- The total number of combined wounds is the top number, that is 579 cases. Those injuries are often combined many kinds of wounds such as sinking head bone, cracked bones, pressured injuries, soft tissue wounds ...This wound is sometime kept pieces of UXO or marbles inside their body, so those victims have often pain that makes victims can not work as well as their abilities.

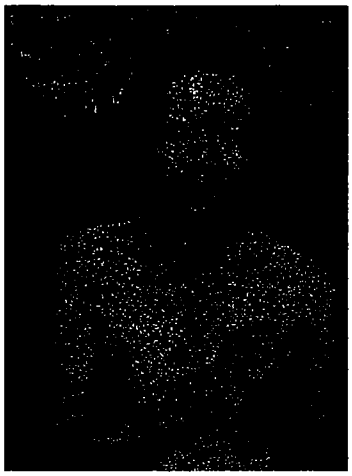
A UXO victim in A Luoi has combined wounds in face, chest. eves. bell. ...



A UXO victim in A Luoi with combined wonds and amputation.

- The total number of deaf by UXO accidents is 99 cases. Including 43 slight cases (decreasing audiogram), 39 medium cases (deaf one side), 17 serious case (deaf two sides). The reasons made victims to be deaf is broken ear-drum or pressure of expoled UXO.

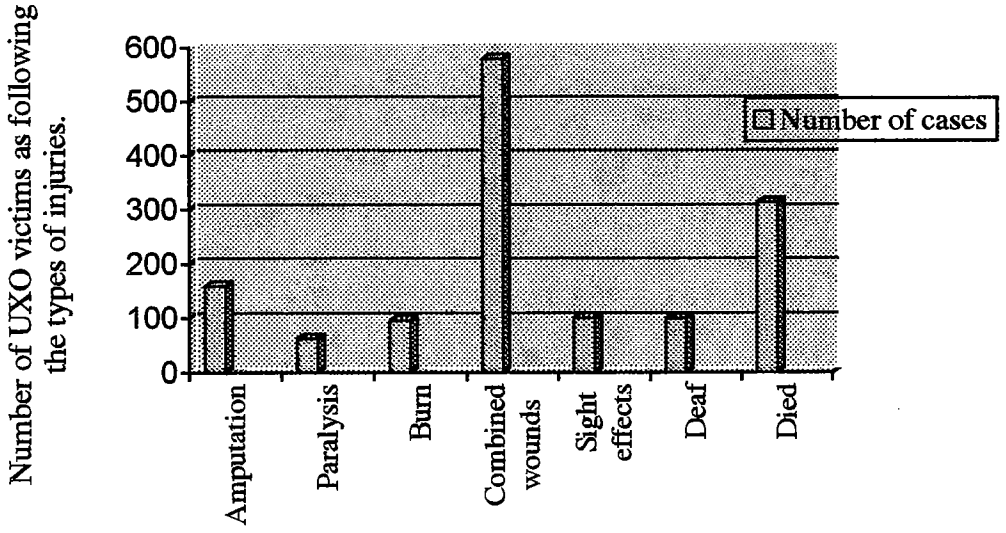
- The total number of case whose eyesight are effected by UXO accidents is 100 cases. Including blind one eye is 62 cases, blind two eyes – 18 cases, decreasing power of vision is 20 cases. In addition, there are some cases were blinded by the sequela of sticky scars caused by burn of UXO.



A UXO victim in A Luoi can not close right eye because of sticky scars caused by Phosphorous Bomb.

A Bombi victim in A Luoi had lost left eye by marbles.

Conclusion, most of UXO accidents often cause the serious injuries for victims. The injuries caused by UXO are multiforms and combined wounds, so it effects to healths and daylife of victims seriously. Those victims need to be healped by medical and social activities in order to be integrated with comunities and society.



Hospital coverage for UXO victims

After the accidents, almost of patients were brought to commune clinic and district hospital. However, those medical glands are limited professional knowledge and equipment, so they often tranfer patients to higher gland that is province hospital by car.

The results of the survey showed that there were 812 cases/1.088 went to see medical bases after getting accidents. Including 348 cases went to commune clinic, 332 cases went to district hospital, and only 132 cases were tranfered to treat in province hospital.

There are many cases were not been treated timely because of many reasons such as died immediately, unknown the situation of injuries, religion, having not condition to tranfer to high gland medical bases...It conduced to results that victims died after some time, or had been treated with serious situations like infectious, serious sequelas.

The survey showed that 32% of victims – 345 cases/1.088 cases were not tranfered to hospital timely, 31 cases/1.088 did not see a medical base, 166 cases/1.088 treated by themsefl by natural leafs, 22 case/1.088 wen to see a wat or monk, and 126 cases/1.088 were treated by their neigbourhoods.

There was 11% of victims – 119 cases/1.088 were treated by operations, and almost of them were only treated for saving of their life primarily but not treated for sequelas like sticky scars...That why those victims are alive but lost working abilities. The evidences showed that there was 95 cases/119 cases were treated by the operation one time, 18 cases/119 cases were treated by operation two times, 5 cases with 3 times, and only 1 case with 5 times.

The locations of UXO accidents.

The survey showed that there was 10% - 115 cases/1.088 cases who had UXO accidents in their communes. Because of the natures of the victims'working like doing on the ricefield or forestry...almost of victims had accidents in the other places which are their working areas.

The top location of UXO accidents is the rice fields – 369 cases/1.088. The second is forest – 157 cases/1.088. Then some other locations are nearby the inhabitant's areas – 137 cases/1.088, roads – 87 cases, grazzing lands – 68 cases, other locations – 91 cases. And don't remember which locations – 179 cases, those cases are the died victims or children.

Activities related UXO accidents

Dicking soil is the top activity caused UXO accidents. There were 501 cases/1.088 cases related this activity – 47% of victims. Including, 480 cases were dicking soil for ricefield, 17 cases for housing, 2 cases for well, and 2 cases for catch insects.

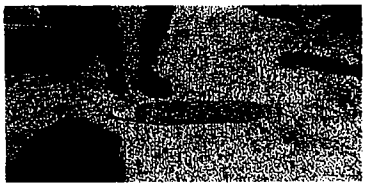
The second activity is *touching to UXO*. There is 26% of victims related this activity. Including, removing or throwing is 56 cases, opening is 24 cases, defussing UXO is 79 cases, and playing UXO is 114 cases.

There is an activity that make us to be noticed, is *Do nothing, touch to UXO suddenly.* This activity is the third reason that caused UXO accidents in A Luoi valley (156 cases/1.088 – 15% of victims). This situation showed that UXO presented in everywhere of A Luoi valley, and the presence of UXO in A Luoi is not only under the land but also on the surface or hided inside the brushwood ...Otherwise, this situation also showed us a lack of education awareness program to A Luoi inhabitants. This activities often caused the accidents for children because they don't often notice about UXO when they play arounds.

The activity that is *burning* is 7% of victims – 73 cases/1.088. Including, burning for ricefield is 39 cases, burning for destroy UXO is 13 cases.

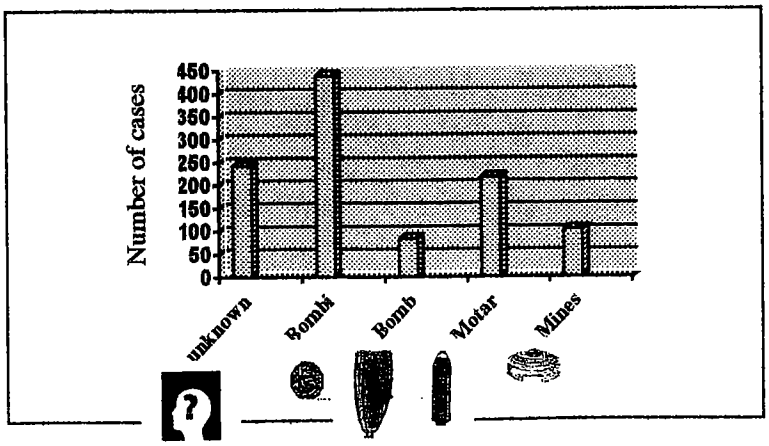
5% of victims had accidents when *cutting* – 58 cases/1.088. Almost of them had accidents when cutting for grass and trees. There are 27 cases is missing vallue of the results of the survey.

A common view in A Luoi valley : the children were grazzing buffalos in the old Ta Bat airbase area, Hong Thuong commune (the right picture) –
- that area has been contaminated a lot of UXO.



Types of UXO related accidents

The top of UXO that caused accidents in A Luoi is Bombis. The number of cases by Bombis is 40% of total cases – 440 cases/1.088. Now, you can see Bombis in everywhere in A L.



Bombi made accidents by some reasons. The common reason is that the metal detector collected it and opened in order to take metals, and the children often played it because of its interesting shapes.

Motar – M79 is the second reason causing UXO accidents. There were 218 cases / 1.088 cases who had accidents by this type of UXO. This type of UXO is still contaminated in A Luoi so much, especially on the surface of old army bases. This UXO will be exploded when it turns enough indispensable rounds, so its accidents are often seen when the farmer throw it unintentionally or the children play it.

One third of victims don't know what types of UXO causing their accidents. There were 243 cases/1.088 – 22% of victims to be unknown the types of UXO.

Because of a long time and flooding, soil erosion,...there are some mines that were burried under the lands, are been on the surface. 10% of victims – 103 cases/1.088 had accidents by mines in A Luoi valley.

Now, you can see some originated big bombs in forest, inhabitants' areas like garden, behind the kitchen, etc...in A Luoi valley. It is a potential risk that will be able cause serious accidents suddenly. The survey showed that 8% of victims – 84 cases/1.088 were died by this type of UXO. Most of them had accidents when they tried sawing it for metals and dynamites.

In some cases, the victims aswered that they didn't know types of UXO causing their accidents, but we could recognize their wounds caused by Phosphorous Bomb.

Social issue with UXO accidents

There are 438 cases/1.088 – 40% of victims who were married and had children. Most of them are providers in their families, so after the accidents, the family's economic has been effected seriously. When interviewed, many victims' wifes cried and aswered : " ...before the accident, he worked very hard work but our families had not enough foods. Now, what we should do...".

The table 4.B and 5.B showed us the social issue of victims' families. Now, we have some centers for orphan children and handicap children, but we have not had any center for children who have hard lifes. Therefore after the families' provider had lost working abilities, those children had to leave school and to work hard.

Tbale 4.B : Number of children whom the victims had

Number of child	Number of victim	Number of child	Number of victim	Number of child	Number of victim	Number of child	Number of victim
0	49	3	61	6	27	9	3
1	108	4	48	7	10	10	2
2	90	5	31	8	7	11	2

Table 5.B: Occupation of victims after getting accidents

Occupation	Number of victims before accident	Number of victims afterc accident
Unemployed	189	430
Specialist	10	13
Officer	19	20
Soldier	35	2
Veteran	5	
Worker	33	
Farmer	657	567 ?
Housework	0	0
Others	140	56

The above table showed that unemployed people are increased 4 times after getting accidents in A Luoi valley. Including, the officer and specialist working are relatively mantained. The occupations related manual labourers are almost lost. Actually, we have not yet been believed with the aswer of farmers because many inhabitants thought that they are farmers, even when they stay at home. This problem can be explained by two reasons, as below:

- Most of A Luoi inhabitants are lived by doing ricefield through many generations.

- The technical interview of interviewers is not so good.

CHAPTER III

SUMMARIZED ANALYSIS OF THE SOCIO-ECONOMIC IMPACT OF UXO IN A LUOI

I. IMPACT ON THE VILLAGE COMMUNITY

UXO contaminated in A Luoi are impacting the village community directly through the death and disabling of its members, and indirectly through the uncertainty it introduces into village life. Survey results show that the average age of people having accidents with UXO was 25 year olds, with 91% of victims – 989 cases/1.088 cases being aged between 5 – 50 year olds. This means that UXO – related accidents arekilling and disabling people who are in their most productive years. This affects the living standards of individual families and inderectly the economy of the whole district.

II. HARDSHIPS CAUSED BY THE DEATH OF A FAMILY MEMBER

The death of one of the family's most productive members is especially hard for families of victims. Inhabitants reported that families do suffer a decrease in their ability to produce food and generate essential income. Although the majority of victims are adult men, the loss of an adult woman in an agricultural sociaety is equally devastating. Apart from the obvious emotional loss, both men and women are heavily involved in various activities around cultivating and preparing fields...

After such a death, other family members, especially the children, have to take up any extra workload or reduce the area of land cultivated. Children are placed at risk because they are forced to work in the very fields that caused the death of their father or mother. As well, having to take up an extra burden of work severely affects the ability to these children to fully participate in educational activities. This then creates a spiral of improverishment as children are less educated and the family's financial and social status diminishes. Although other family and community members do contribute labour and give assistance in any way they can, in a subsistence economy this can be limited and impact on the family can still be very severe.

Financial burden of UXO accidents

With injuried victims by UXO, the expenses of medical care for those patients is costly. Including, the expenses for transportation from A Luoi to Hue is aleast 300.000 VND – 500.000 VND, the expenses for operation averagely is

10.000.000 – 15.000.000 VND / per case, otherwise we can not canculated the expenses for victim's families'member taking care them in the hospital.

With the died victims, their families have not yet been ungiven money for the victims. The expenses for funeral in A Luoi valley is costly because of the religion of ethnic groups in here such as drinking and eating 3 days, killing one pig or one cow, worshiping ....

III. ATTITITUDES TOWARD DISABILITY

During the survey it was reported to the survey team that people with disability were denied access to certain professions or callings that are seen as being of high status in a community, such as school teacher or commune's officer...One example of discrimination against a suvivor of a UXO accident observed during the survey was a commune's officer in Hong Kim commune. This officer was not allowed to work in commune's office because he had lost one hand and one lower arm in the otherside. The man and his family now suffer the consequences, becoming increasingly improverished and having lost significant status in the commune.

Although disability can severely limit a person's ability to participate in not just high status jobs but in more general village life, there is some evidence that A Luoi inhabitant with disabilities are to a certain extent accepted and are still able to work. Some of victims with UXO related disabiliyies are currently still working in their fields according to the survey results; however majority of them doing nothing. Those victims are needed a help from their families for being able to return to the fields, and they are also needed a help from local medical organization such as false limb, special equipment ...

There is one issue that makes us to be noticed. There is 52% of victims, disabled people did not marry after the accident – 402 cases/1.088. It should knowed that those single victims are very difficult to intergrate into the community by their injuries, and the helps from community and their family will be limited until the adult age. Therefore this issue makes single victims will be more and more separate with community.

IV. IMPACT ON THE AGRICULTURAL SECTOR

In the agricultural sector, the impact of ordnance has been, at times, quite severe. A Luoi farmers did not significantly change their agricultural practises after the war. They continued to grow rice in upland or lowland fields, supplemented by produce from their gardens and forests. It might have been expected that people would modify their farming systems to accommodate UXO contamination. Farmers could have reduced rice cultivation, increased livestock breeding, increased off-farm activities or made other adjustments that would have reduced their contact with UXO. This, however, did not appear to have occurred – A Luoi inhabitants do not leave land fallow

because they suspect the presence of UXO. The method of delivery of the majority of the ordnance meant that contamination is so widespread that it is impossible for inhabitants to define a precise areas free of contamination.

1. Restrictions on land use due to UXO

Consequently, land denial and the socio-economic impact in this sector is hard to qualify in A Luoi, many inhabitant reported that agricultural land contaminated to the extent that it is currently under-utilised or can not be cultivated as the farmer would like. The inhabitants have had no choice but to continue to farm and use their land, only avoiding those areas believed to contain landmines.

Inhabitants reported that ares which had large military camps or important airbase like Ta Bat or A So were usually protected by minefields or surrounded by air-delivered mines. The approximate boundaries for these areas were know by the local villagers and these areas were subsequently believed to be too dangerous to build houses, to cultivate rice or even graze animals.

A family in Hong Kim commune buried > 200 cartridges in the garden that is area of standing by interviewers.

Some inhabitants also reported that certain UXO-contaminated areas were formerly very fertile and useful for cultivation. Some of these areas have already been marked and fenced by the local community or district officials to stop children and animals from wandering into them. This could explain the decreasing accidents figures caused by mines, since people now know and are avoiding these areas. However, this does not mean that the problem of contamination has decreased, especially since village communities do not move or touch UXO. Thus, although not causing the majority of accidents, UXO are still a significant problem in some areas and are perhaps the only ordnance strictly causing "land denial".

2. Types of land impacted

Despite A Luoi farmers fears regarding UXO in agricultural fields, the survey show that the number of accidents occurring on agricultural land is decreasing over time. Within this, the survey results indicate that more accidents have

occurred in upland rice fields than lowland. The majority of affected areas are located in moutainous district like A Luoi where upland agriculture is dominant. This holds true for the A Luoi because the A Luoi is lied on the Ho Chi Minh trail areas.

The results of the survey show that 34% of total accidents in A Luoi valley were happened on the fields, and most of them were on the upland.

However, now A Luoi have many project to develop agriculture such as wet rice cultivation, rice stair cultivation on upland,...So the number of accidents on the upland trend to decrease with lowland recently.

Based on the results of the UXO survey, the number of interviewees seen UXO in the forest is higher than on the fields. A Luoi is an area that need to be developed for forestry, so this contamination will effect to forest recovering in A Luoi valley seriously.

3. UXO with relocation of A Luoi inhabitants.

Information collected during the survey indicates that caution should be practiced when considering village relocation plans. At present, there is a Government policy to relocate some upland villages to lowland areas in order to stop slash and burn agricultural practices. In addition, villages relocat by themselves in order to be closer to roads or other services. Some communes have experienced incresasing accidents numbers, mostly due to new commune resettlements like A So and during the time of resettlement such as 1973-1975. Since thi survey was based on data from populated areas, no data was gathered about areas that are designated to be resettlemnt sites. To some extent the situation can be estimated from neighbouring communes but this will not be precise. It would be preferable that UXO reconnaissance be done an any new relocation site suspected to be contaminated and that the situation of communities be carefully monitored.

In these relocation sites, one of the major activities that resettled people will have to undertake is the opening and establishment of new fields. Opening new land for lowland paddy rice cultivation was a major cause of accidents occurring in the agricultural sector. This involves a large amount of intensive labour to cut down bushes and uproot trees, remove topsiol and build canals and retaining walls. All of these activities are potentially of very high risk and could result in an increase in accident figures. Generally speaking farmers are very concerned by UXO contamination in agricultural land. Frequent requests were made asking for these areas to be cleared of UXO, so that farmers could feel secure working in their fields or oprning up new areas for cultivation.

4. Impact of irrigation schemes

An other part of the agricultural sector that may face problems in UXO – contaminated areas are irrigation chemes in lowland ricefields. The construction of these schemes often involves intense and invasive excavation

of the site, which is potentilly dangerous in UXO affected areas. All the area around an irrigation sheme requires clearance but there are also parts of the site that require deep, subsurface clearance.

The survey itself did not report a significant number of accidents occurring during the construction of irrigation schems, but anecdotal information was supplied by individuals and one company working in this area. They suggested that there are certain problems encountered by both villagers and copanies contructing these schemes. Despite fiding UXO on the irrigation scheme's site, villagers continue with their fileds. It is not enough standards of safety for working like that, those site need to be cleared before construction begins.

V. UXO WITH ENVIRONMENT

Now, effects of UXO to environment is not clearly; however, there are some ideas that UXO can effect to environment by heavy metals. As we known can cause some serious disease including malformation deformities.

In order to define the environment has been contaminated by heavy metal ro not is not simple works. However, we should not forgive this issue, but we need the helps from International experts and laboratories.

VI. UXO WITH INFRASTRUCTURE

1. Impact on the national road system in A Luoi valley

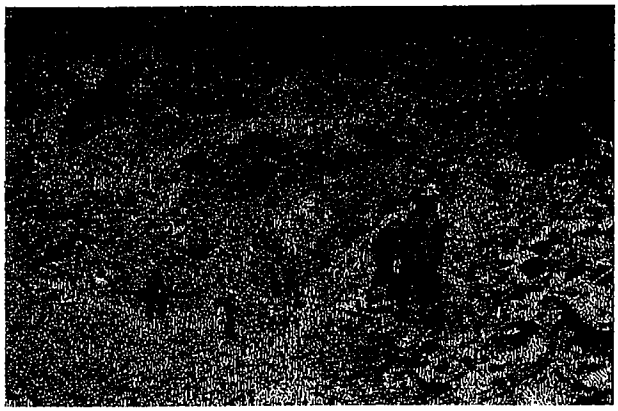
As we known, now the Viet Nam Government is constructing the High way 1B based on the old Ho Chi Minh trail. This road will be a strategy road system connected South and North of Viet Nam, and it will bring a lot of benefit of socio-economic for areas that the road pass over. There are some parts of this road will be on the A Luoi area such as A Roang, Hong Van ...

However, the parts of 1B high way in A Luoi valley was a major target during the war and large sections were completely destroy during bombing raids. Buiding roads and constructing bridges in this areas with high UXO contamination presents the construction company or organization working on this with certain problems. The area of the actual road surface must be cleared as well as an area approximately 20 metres both sides of the centre line of the proposed roadway. In addition, targeted resource areas for raw materials and any proposed bridge sites must be cleared, some of these sites requiring deep sub-surface clearance.

Following the war there was extensive removal of UXO from road surfaces before reconstruction was started. Unfortunately a number of UXO were incorporated into or under the actual surface of the roads. This will present particular problems for clearance teams, due to the manetic background noise generated by this metalled surface which will make reading by metal detectors very difficult. As well, demolition of possible built-in ordnance could cause

unacceptable damage to the road surface from detonations. The removel of the bitumen by bulldozer ripping before UXO clearance also presents a company with the possiblity of stricking unexploded ordnance during the process.

1B constructing through A Roang, A Luoi valley.



2. Construction of access road and paths

The construction of small rural access roads and paths are more significantly constrained by the presence of UXO than the major highways. These are usually labour intensive, with local villagers using picks, shovels and carrying earth and rubble by hand. In addition, villagers usually were working in groups when these accidents occurred and explosion injuried or killed many people simultaneously.

According to local officials, any such accident understandably stops the community from wanting to work on these projects for many years afterwards. Labour based roads and labour intensive projects working in severely contaminated areas need to be halted and consideration given to the level of UXO contamination in the area. If UXO is suspected, authorities should sundertake some kind of reconnaisance, or if necessary, clearance of those areas before resettlemnt occurs. Alternative methods of road construction need to be considered, perhaps using more machinery rather than relying on human labour which could place local people at risk of injury or death.

VII. DIFFERENCES IN IMPACT ON COMMUNE AND COMMERCIAL ENTERPRISES.

There can be no doubt that the main impact of UXO falls in A Luoi valley communities, severely affecting the families and individuals living in contaminated areas. Most of the accident have killed or injuried village people and the presence of UXO affects their daily life in numerous ways. Commercial enterprises, especially foreign-owned or operated, have the resources an necessary finacial back-up to carry out sometimes extensive clearance of their project areas. This clearance is usually limited only to those areas within the company's project areas and does not consider the needs of surrounding communities.

CHAPTER IV

SOME RECOMMENDATIONS SOLVE THE UXO PROBLEM IN A LUOI VALLEY

In order to solve the UXO problem, it needs to get the collaboration between Government organizations and local organizations, and also need the helps from humaniterian organizations, N.G.O ...The absoluted mitigation program need spending a lot of times, budget and techniques suitable for every areas. Based on the survey, we only recommend some solutions solving UXO in A Luoi valley. We do not concern about the technique's aspect, and we only introduce some lines of action.

I. EDUCATION AWARENESS PROGRAM

While waiting for the cleared operations, the education awareness program is very important. The purpose of this program is to provide the indispensable knowledges for inhabitants about the risks of UXO and how they should do to avoid the accidents of UXO. This program will participate into decreasing the number of UXO accidents.

1. **Carry out some training courses** for many unions of the district such as medical organizations, youngth union, veteran association, propagated organizations, and especially for pupil in the schools of A Luoi valley. The main contents of the training course as below:

   - The common types of UXO that the inhabitant often seen, properties and mechanism of those UXO.
   - The ways that the inhabitans can do to avoid and act when seeing those UXO.
   - How should the inhabitants do to tranfer and do the first aid for victims.
   - Methods that inhabitants do to propagate the UXO's risks to others.

2. **Produce some posters** that propagate about common types of UXO, effects of UXO, and how should we do to avoid UXO. Those posters will hang or stick on the public areas such as schools, health clinics, post office, markets,...The posters will bring to inhabitants some indispensable information about UXO contamination in local areas.

3. **Produce some cassett and video tapes** in order to propagate on the local public radio and television to inhabitants again and again with the contents that is impacts of UXO and UXO preventing ways. By this way, we can tranfer some indispensable information of UXO to inhabitants by speaking and pictured magazines.

4. **Produce a leaflet and pictured book** in order to distribute for pupil in every school of A Luoi valley. The contents of the leaflet and the pictured book like the stories that educate about effects of UXO and preventing accidents of UXO.

5. Although having not a detail survey of UXO, the local authorities should collect information from old people, children, farmers,...in order to **delineate the contaminated areas** and **set up the UXO dangerous boardings** in there.

II. CARRY OUT THE UXO CLEARED OPERATIONS IN CONTAMINATED AREAS.

1. **Investigate and make plans** is the first step of the operation. This step would be done by combining many kinds of information such as history war, surveys, sattelite immagery, fieldworks,... So that we can implement the operation that is fixed with the local situation.

2. **Implement the cleared operations in priority areas** . Those areas are that has old army bases, high rate of accidents, and is necessary carried out the resettled programs for inhabitants. The priority program is not only solving the UXO problem in some seriously contaminated areas but also making the pilot of the larger scale of the operations.

3. **Some technical attentions when demining and destroying UXO** that are Dioxin contamination and erosion in A Luoi valley. During the war, A Luoi was sprayed herbicides heavily. Base on the recent assessment of 10-80 Committee and Hatfield Consultant, A Luoi environment is still contaminated with high level of Dioxin, especially in some areas that have old army bases like A So. Therefore the a question is given that how should we do the cleared operation in order to guarantee safety for workers and to do nothing for spreading out of Dioxin contamination.

   In addition, A Luoi is often gotten erosions during the period time of raining season. So which techniques that we should do in order to do nothing for more seriously than before with the operations.

4. **Implementing the large scale cleared operation through out A Luoi valley** will be done when local authorities, techniciants, consultants, planners,...have enough information of UXO in A Luoi valley, the feasible plans and techniques for the operation in local areas. The orther we should concern that are budgets for the operation. By the internal forces, we should combine this program with the poverty cancel program of Government, Province for the local areas. On the other hand, we should call upon the helps from International humaniterian organizations, N.G.O,...

III. TASKS OF MEDICAL WITH UXO PROBLEMS.

1. **The first aid for the UXO victims** after accident is very important. The victim is or is not saved lively before and due to tranfer to higher gland of hospitals, depending on this working.

   Base on the survey, we know that the UXO victims in A Luoi were given sparse emergency aids after the accidents, and the top reasons a lack of knowledgs of trauma emergency aid of medical techniciants and a lack of equipment. In order to overcome this essential point, we have some opinions, as below:
   - We should implement some training courses for A Luoi medical tchniciants by the lectures of trauma first aid that would be teached by experts of this aspect such as army doctors.
   - Equiped all of indispensable equipment of the trauma first aid for A Luoi Health Center, clinics. And priority to provide those equipment for some communes where hve serious UXO contamination.
   - Organize some moving emergency teams of A Luoi Health Center. Those teams can reach to the accident areas and rescue victims quickly.

2. **Rehabilitating and dealing sequela for UXO victims** in order to return all or a part of victims' healthy and working abilities. This work should be done as follow some steps, as below:
   - Investigate, then examine and make the health records for victims.
   - Operate for some victims in order to deal sequelas like operating stick scars, amputation's top, ...
   - Rehabilitating for victims in their communities will help victims to be able to intergrate with social communities around him or her.
   - Set up the false limb for amputation victims.
   - Produce some special equipment to help the victims in their daylife.

IV. SOCIAL ACTIVITIES WITH UXO VICTIMS

1. **The social policy for victims should be concerned.** Save alive victim is difficult, but return them to communities is not easy. The medical organization, the social & labour organization, and local officials should be co-operated to have a reasonable policy for UXO victims and their family. The policy should be enough to guarantee the victims and their families overcoming the hardship caused by accidents.

2. It is recommended that an **ongoing system for monitoring UXO accidents nationa-wide be established and maintained**. This system would be build on the current data base and provide invaluable information on accidents at village level. It would also provide some indication of whether UXO contamination is causing ongoing problems or is more static in certain areas. This would assist clearance and community awareness operations in deciding on priority areas.

CHAPTER V

ANNEXES

ANNEX I	UXO COMMUNE QUESTIONAIRE
ANNEX II	ACCIDENT FORM
ANNEX III	SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE
ANNEX IV	SOME PICTURES OF AWARENESS EDUCATION PROGRAM DONE IN A LUOI IN AUGUST, 2001

ANNEX I

COMMUNE FORM

Box 1 - to be filled by the supervisor

1. Commune name:	**2. Commune population:**		**Commune code:**
3. Other name of the same village (from district or people...)			
4. District name:	**5. Province name :**		
6. Supervisor name:	**7. Office:**		**8. Position:**
	9. Age:	**10. Sex:** Male Female	**11. Involved the war ?** Yes No

Box 2 - to be filled by data-collector

1. Interviewer name:	**2. Commune:**		**3. Occupation ?**
	4.Age:	**5.Sex:** Male Female	**6. Involved the war?** Yes No

Box 3 - to be filled by data-collector

1. Interviewee name:	**2. Age:**	**3. Sex**	**4.Occupation:**	**5. when have you lived here ?**
6. Have you seen any UXO in the village ?	No Few Many Everywhere			
7. Date of the interview (DD/MM/YY)	**8. Finish time:**		**9. Estimated duration(')**	

Box 4 - To be filled by data-collector

1. When did your village settle here ? ➡	Before the war ☐ After the war ☐	When ?
2. Previous name of the commune ➡		
3. How do you live here ➡	Permanently ☐ Temporary ☐	
4. Did you live here during the war ? Yes No	If no, Where:	From : To:

Box 5 - to be filled by data-collector

Was your commune bombed by aircraft during the war ?

No Yes ➡ 1. How many time ? : 1□ 2-5 □ 6-50 □ >50 □

Do not know

	Year	or Season	Month
When did it begin ?		Spring Summer Autumn Winter	
When did it finish ?		Spring Summer Autumn Winter	

2. How many bomb craters are there still now in the area of your commune ?:

a. Small (like buffalo watering hole): b. Big (like a house) :

3. Did any aeroplane crash in the territory of your commune ?

Yes No

Box 6 - to be filled by data-collector

Were there any ground battles in the territory of your commune during the war ?

No Yes ➡ What kind ? Airbase Army station Other

Do not know

Where was it from the village center ?

? km or m:	Which direction ?
	East West South North East-north West-south East-south West-North

Box 7 - to be filled by data-collector

1. Are there any unexploded bombs or bombies (UXO) in your commune ?

No Yes Do not know

2. Are there any land mines in your commune ?

No Yes Do not know

Box 8 - to be filled by data-collector

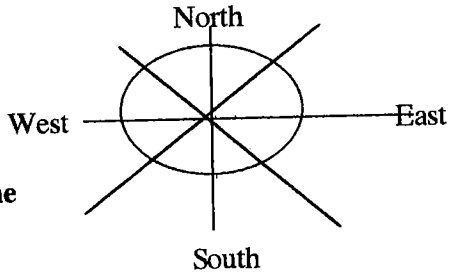
1. In what kind of land or places did you see some UXO ?

near house in commune	on or along path of road	Rice field	moutain area	Grazzing land	near forest	in forest	other	every where

2. From here, where are the areas where you see some UXO

All over the commune Only in few area

(Which direction ?)



3. How many families of the commune have visible UXO/Mine on their field ?

4. What is the total area of agricultural land where you see UXO ? :

Box 9 - to be filled by data-collector

1. What have you been doing when seeing UXO ?

Inform to authorities of commune and District ? Yes No	Throw to other place ? Yes No	Recycle it ? Yes No	Other - tell ?

2. What have your inhabitant been doing when seeing UXO ?

Inform to authorities of commune and District ? Yes No	Throw to other place ? Yes No	Recycle it ? Yes No	Other - tell ?

Box 10 - to be filled by data-collector

1. Is there any idle land you would like to use but cannot use due to the presence of UXO ?
- How large would you need ?

Land field	Grazzing land	Housing	Reforestation	Other - tell ?

Box 11 - to be filled by data-collector

1. Since the end of the war, did any person in your family get injured or die due to UXO ?
No Yes ➡ How many persons ? :

2. Since the end of the war, howmany people in your commune get injured or die to UXO ?

Male:	Female:	Children :	Total :

If possible, give me name of victims

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

3. Since the end of the war, did any animal of your commune die because of UXO? :
No Yes ➡ How many :

Buffalo:	Cow:	Pig:	Chicken, duck:	Other:

Box 12 - to be filled by data-collector

1. Have you ever seen people searching for UXO or scrap metal with metal detectors ?
No Yes ➡ When did you see ? :
Who are they ? :

Box 13 - to be filled by data-collector

1. Are there any program of Government (commune, District, province...) **to solve the UXO problem in your commune ?** No Yes

2. Are there any supporting from District or commune for UXO's education ?

No Yes ➡ Which way ? : Education ☐
Provide equipment ☐
Make abanded area ☐

Box 14- to be filled by data-collector

1. Since beginning of the war and aside from the bombings, have you ever seen any other effects due to the aeroplanes on the territory of your commune No Yes ➡

All the foliage of the trees in the forest becoming yellow and dying	No Yes	When	Howmany time
All rice leaves turning yellow and dying leading to no havest at all	No Yes		
All the fishes dying very suddenly	No Yes		
Many other animals dying suddenly	No Yes		
Most of the people suffering from eye burning	No Yes		
Most of the people suffering from skin burning	No Yes		
Most of the people suffering from respiratory suffocation	No Yes		
Most of the people suddenly dying	No Yes		
Other effects:			

Box 15 - to be filled by data-collector

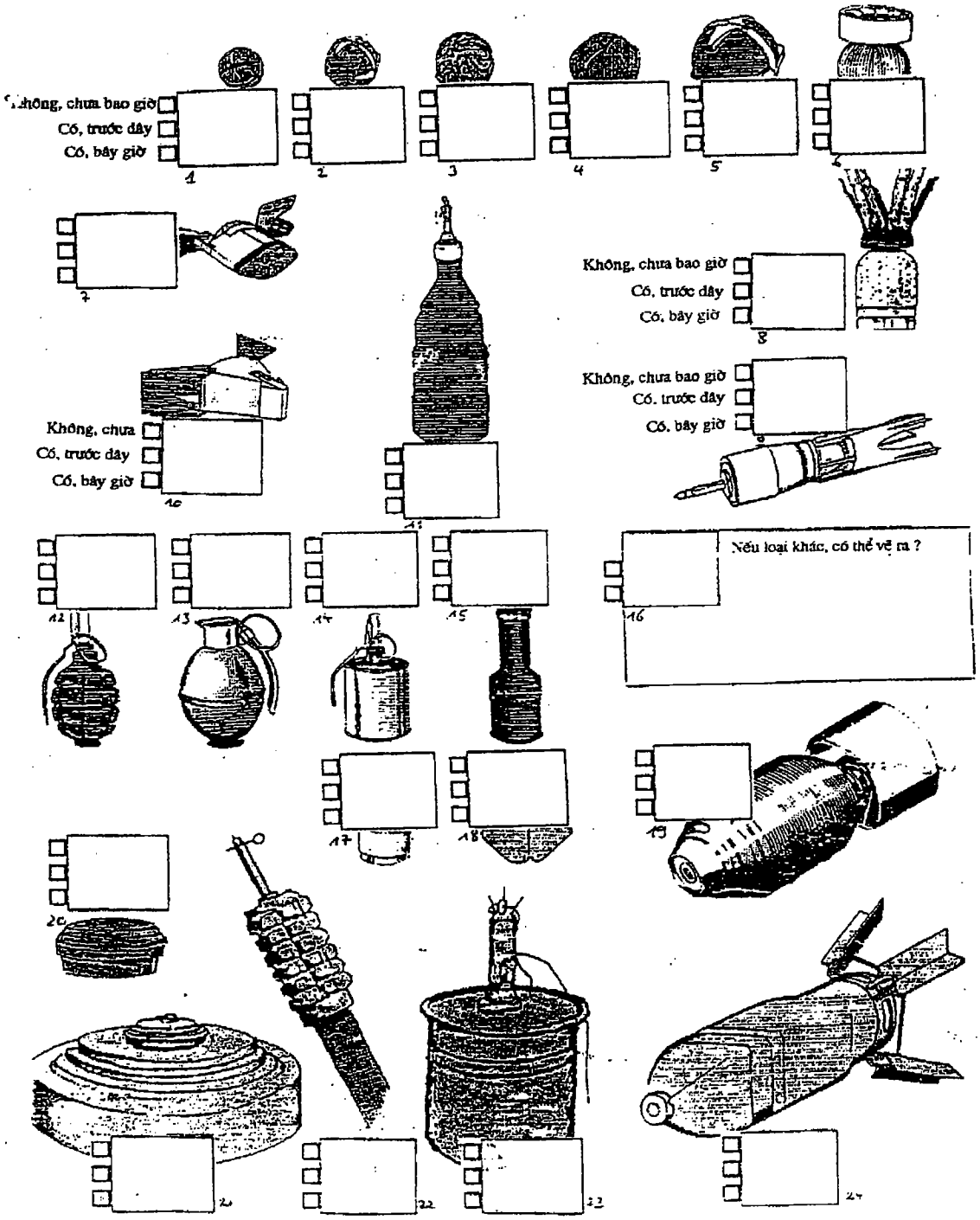
1. Is there at present anybody from outside your commune supporting your commune with a project ? No Yes ➡ Health improvement ☐ Agriculture ☐ Water supply ☐
Road constructure ☐ Education☐ Other☐
Who are they ? : Government ☐ NGO ☐
Name of Organization:

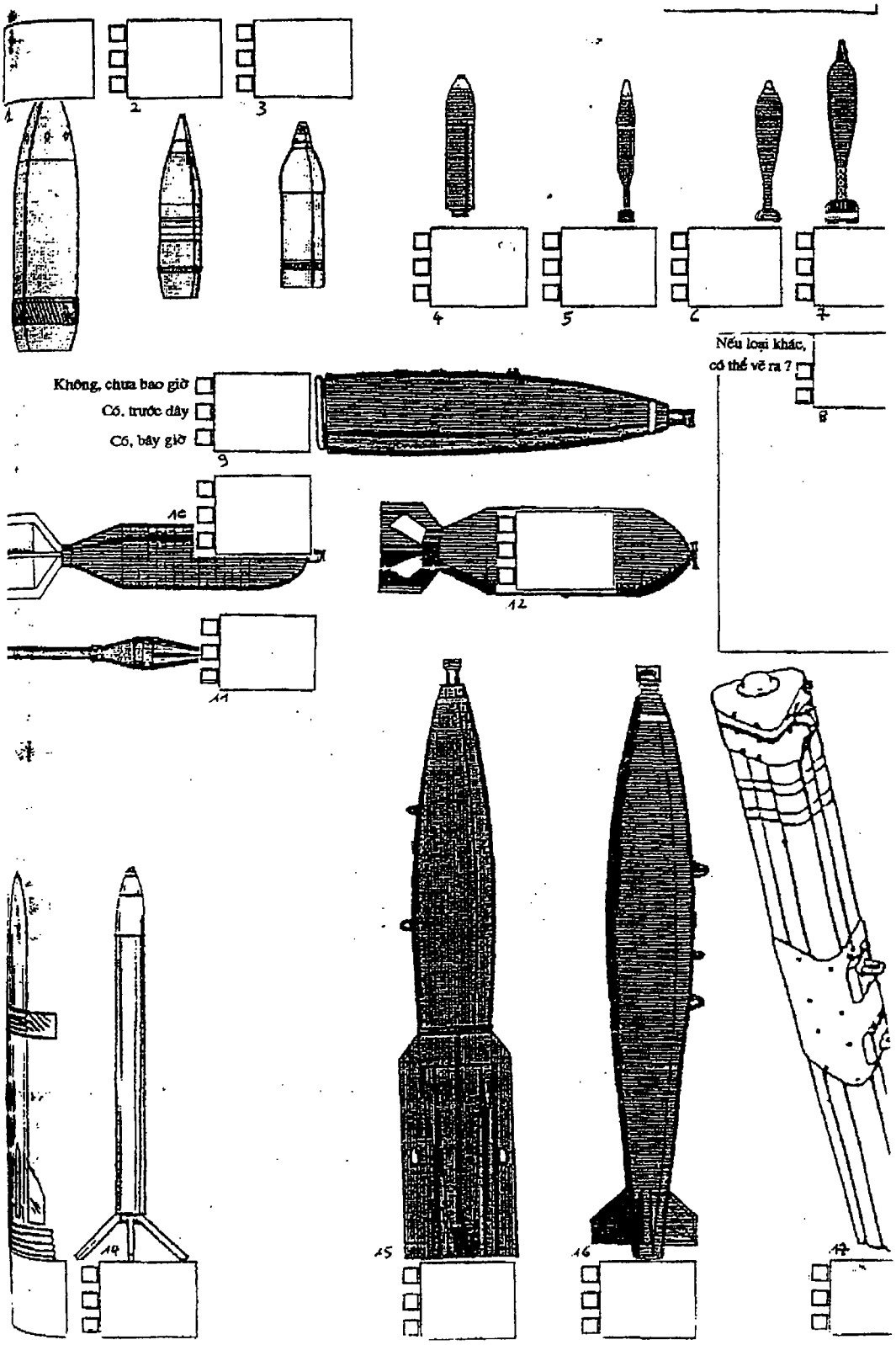
Box 16 - to be filled by data-collector and survey management group.

	DD/MM/YY	Name	Signature
Interviewee			
Interviewer			
Supervisor 1			
Supervisor 2			
Data inputer			
Data analyser			

PICTURED SURVEY

Have you ever seen this kind of UXO ?




Không, chưa bao giờ
Có, trước đây
Có, bây giờ
Nếu loại khác, có thể vẽ ra ?

ANNEX II

ACCIDENT FORM

Box 1 - to be filled by data collector

Victim name:	**Age:**	**Sex:**	**Commune name:**	**Commune code:**
District:	**Province:**		**Interviewer name :**	**Signature**

Box 2 - to be filled by data collector

When did the accident happen ?

Day	Month	Year

Box 3 - to be filled by data collector

Are you victim ?

Yes

No ➡ a. What relationship did/do you have with the victim?:

husband, wife ☐ Sister/brother ☐ Parent ☐ Cousin ☐

Uncle/autine ☐ Friend ☐ Other ☐

b. Did the victim die ?

No ➡ Where is the victim now :

Có ➡ How long after

Immediately ☐

After sometime :

hour	day	month	year

Box 4 - to be filled by data-collector

1. How old was the victim at the time of the accident? :
2. Was the victim living in the commune ? : Yes No ➡ which commune :
3. Did the victim get the accident in the commune ? : Yes No ➡ where:
4. Was the victim maried at the time of the accident ? : No Yes ➡ How long :
5. If not die, is the victim maried now ? : No Yes
6. Did the victim have any children at the time of the accident ? : No Yes ➡ How many :
7. The victim's occupation before the accident:
8. The victim's occupation after the accident :

Box 5 - to be filled by data-collector

What kind of injury was it ?

Amputation	Arm	Forearm	Hand	Finger	Thigh	Shank	Foot	Toe
Right								
Left								
Paralysis	1 arm	2 arm	1 leg	2 legs	1/2 body		All body	Other:
Burn	Face	upper limb	Chest	Lower limb	All body		Other:	
Wounds	Face	upper limb	Chest	Lower limb	All body		Other:	
Blind	1 eye		2 eyes		Other:			
Deaf	Slight		medium		Serious		Vrey serious	

Box 6 - to be filled by data-collector

What did the victim do after the accident for treatment ?

Nothing	Went to neighbourhood	Other
Treated him/herself	Went to commune clinic	Any surgery ?
Went to the wat or monks	Went to health center	No Yes
Went to traditional doctor	went to province hospital	? times :

Box 7 - to be filled by data-collector

1. Did the accident happen in the commune ? No ➡ which commune ? :

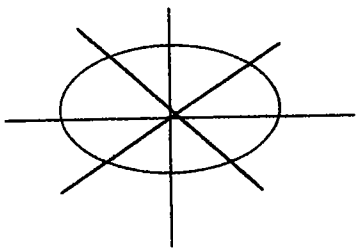
Yes

2. In what kind of place did the accident happen ?

commune	road	land field	Grazzing land	near or in forest	Other:

3. From here, where exactly the accident happened :

Ask the direction and estimated distance in kilometre from commune center.



Box 8 - to be filled by data-collector

What was the victim doing when the accident happened ?

Dicking for: rice field☐ Well☐ Housing☐ Catch insect☐ Other☐

Burning for: rice field☐ cooking☐ gabage☐ Destroy UXO☐

Cutting for: tree☐ grass☐ grow animal☐ other☐

Touch to UXO:

removing, throwing☐ defusing it☐ Opening ☐ play it☐

Do nothing, touch to UXO suddenly☐

Box 9 - to be filled by data-collector

1. What kind of UXO /mine was it ?: Bombi☐ Big Bomb☐ Grenade☐ Mine☐ Don't know☐
2. Did the person know that there was UXO/mine in this place ? Yes No
3. Did the person know the danger of UXO/mine ? Yes No

Box 10 - to be filled by data-collector

Has this place ever been cleared before ? Yes No Don't know
If Yes, ➡ Who cleared it ?:

Box 11 - to be filled by data-collector

Was there any one else injured or killed during the same explosion ?
No Yes ➡ How many persons ? :

Men:	Women:	Children:

If possible, give name of those persons :

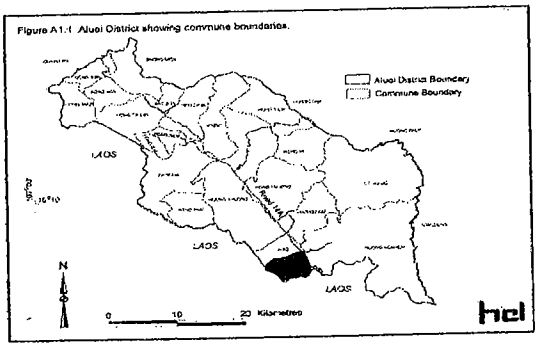
1	2	3	4
5	6	7	8
9	10	11	12

Box 12 - to be filled by data-collector and survey management group.

	DD/MM/YY	Name	Signature
Interviewee			
Interviewer			
Supervisor 1			
Supervisor 2			
Data inputer			
Data analyser			

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY



A ĐỚT COMMUNE

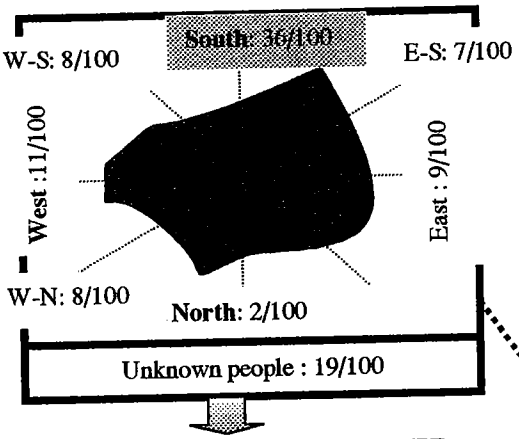
CENSUS OF POPULATION 1995

Number	Total	Now, population
Families	257	
Population	1.767	1.855

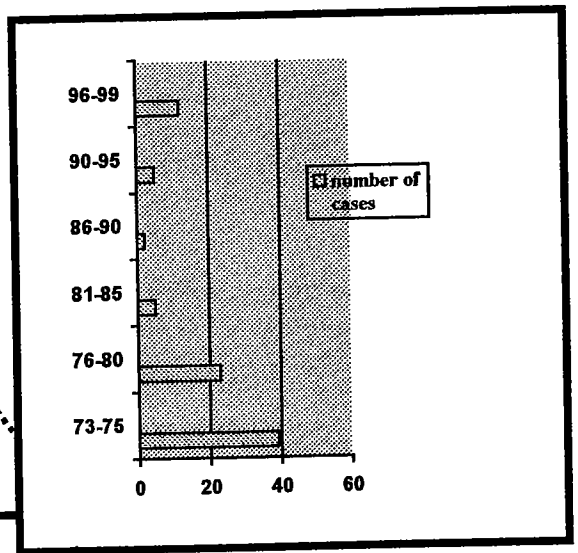
UXO AND ACCIDENT SURVEY, 2001

Survey	Number of interviewees
UXO	100 people
UXO accident	89 victims

DIRECTIONS OF CONTAMINATED LOCATION



NUMBER OF VICTIMS - YEAR

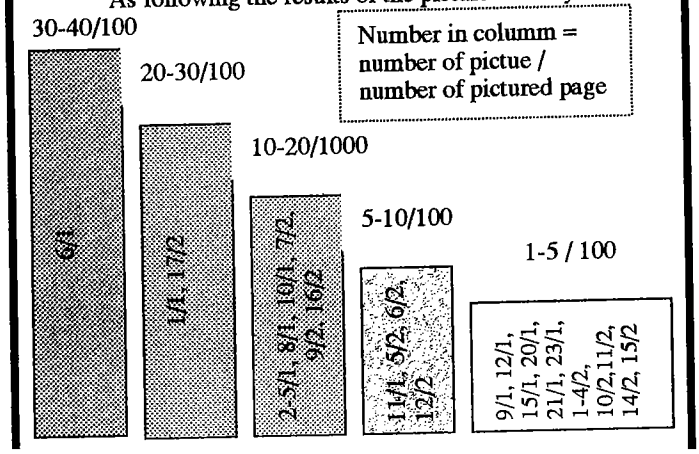


TYPES OF UXO THE INHABITANT SEE

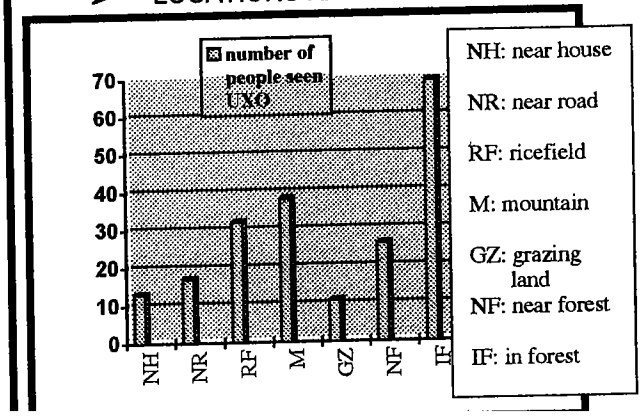
Classified as following the number of people seen

Number of interviewees seen the types of UXO

As following the results of the pictured survey



LOCATIONS HAVE UXO



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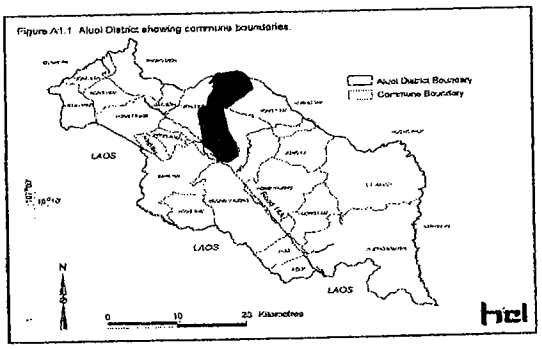


A NGO COMMUNE

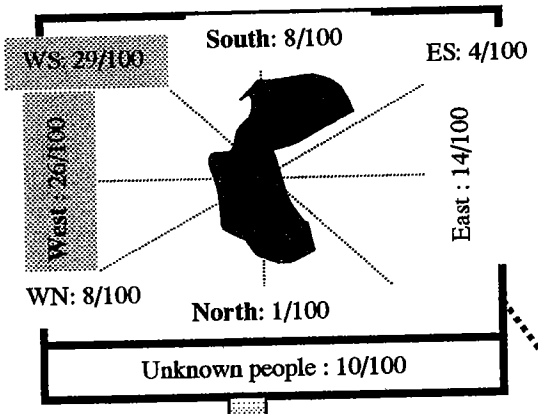
CENSUS OF POPULATION 1995

Number	Total	Population now
Families	707	
Population	4.012	4.500

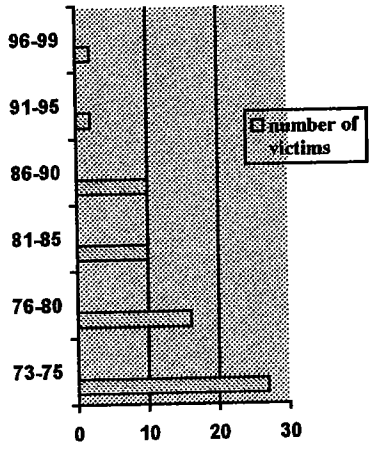
UXO AND ACCIDENT SURVEY, 2001

Survey	Number of interviewees
UXO	100 people
UXO accident	67 victims

DIRECTIONS OF CONTAMINATED LOCATION



NUMBER OF VICTIMS - YEAR



TYPES OF UXO THE INHABITANT SEE

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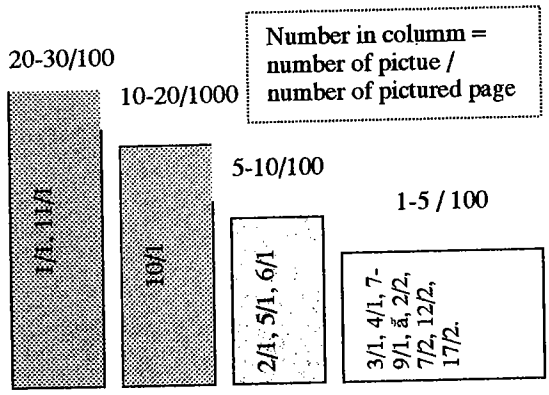
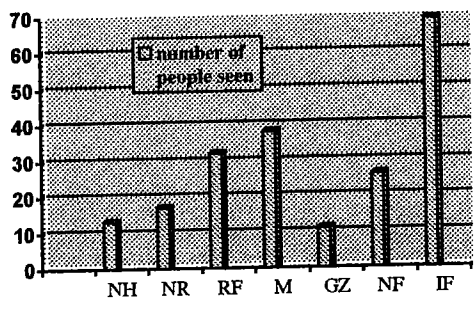
Number of interviewees seen the types of UXO
As following the results of the pictured survey



LOCATIONS HAVE UXO



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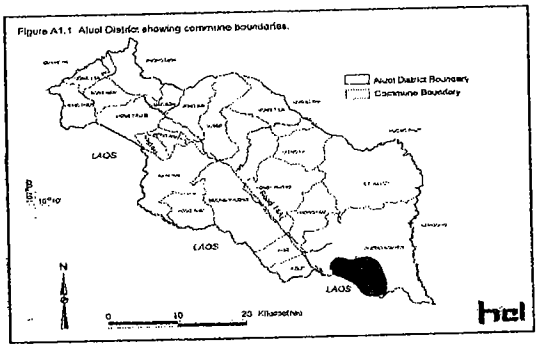


A ROÀNG COMMUNE

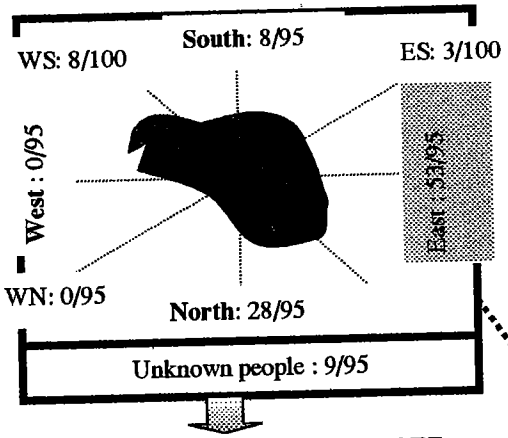
CENSUS OF POPULATION 1995

Number	Total	Population now
Families	281	
Population	1.767	2.065

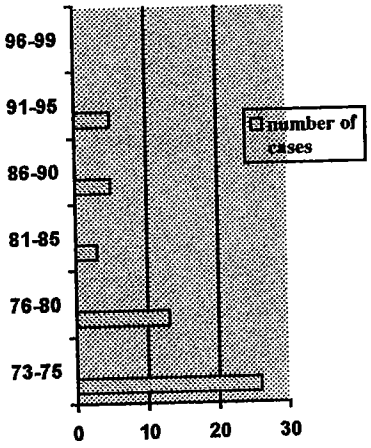
UXO AND ACCIDENT SURVEY, 2001

Survey	Number of interviewees
UXO	95 people
UXO accident	52 victims

DIRECTIONS OF CONTAMINATED LOCATION



NUMBER OF VICTIMS - YEAR



TYPES OF UXO THE INHABITANT SEE

Classified as following the number of people seen

Number of interviewees seen the types of UXO

As following the results of the pictured survey

Number in columm = number of pictue / number of pictured page

10-20/1000

1/1, 2/1, 2/2, 3/2

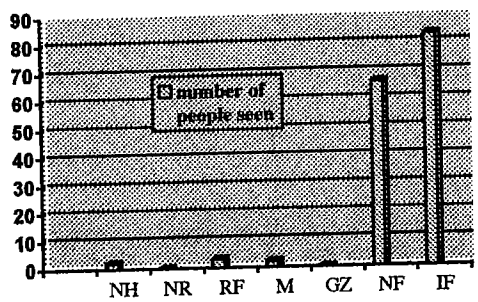
5-10/100

13/1, 16/2, 17/2,

1-5 / 100

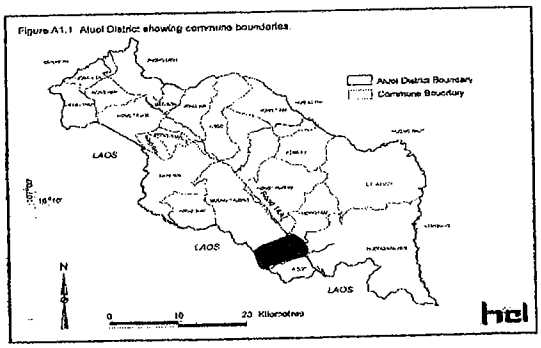
3-8/1, 10-12/1, 14/1,15/1, 24/1, 4-6/2, 9/2, 11/2, 12/2,

LOCATIONS HAVE UXO



ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY



A SO - ĐÔNG SƠN COMMUNE

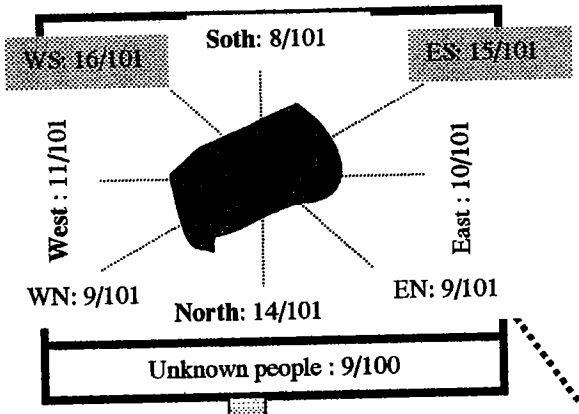
CENSUS OF POPULATION 1995

Number	Total	Population now
Families	173	
Population	990	1.189

UXO AND ACCIDENT SURVEY, 2001

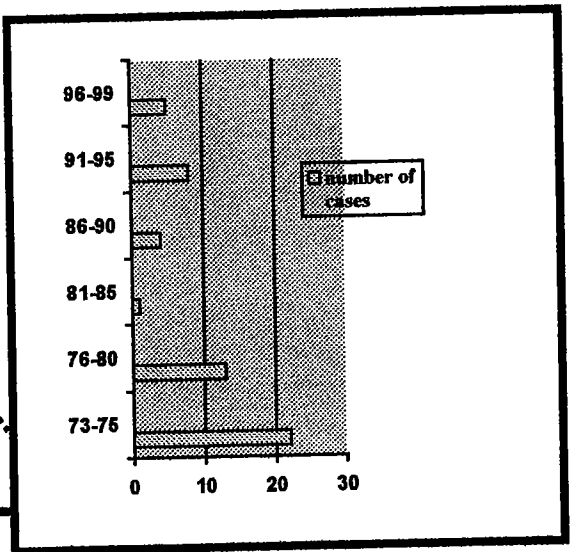
Survey	Number of interviewees
UXO	101 people
UXO accident	52 victims

DIRECTIONS OF CONTAMINATED LOCATION



Unknown people : 9/100

NUMBER OF VICTIMS - YEAR



TYPES OF UXO THE INHABITANT SEE

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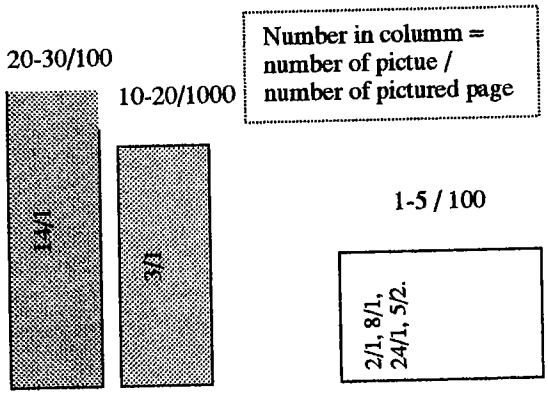
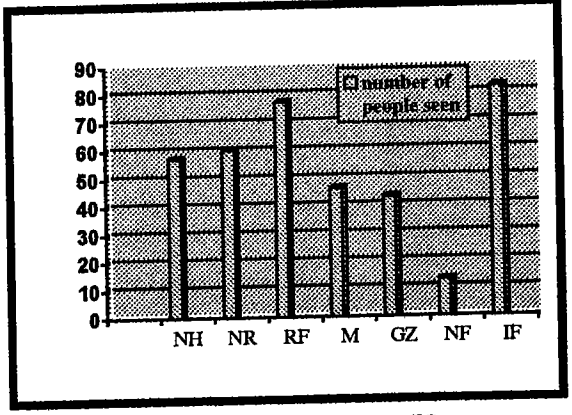
Number of interviewees seen the types of UXO

As following the results of the pictured survey



LOCATIONS HAVE UXO



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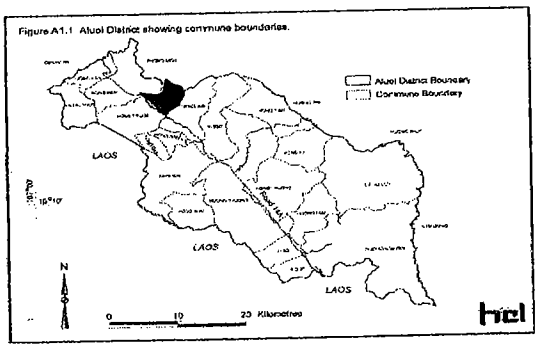


BẮC SƠN COMMUNE

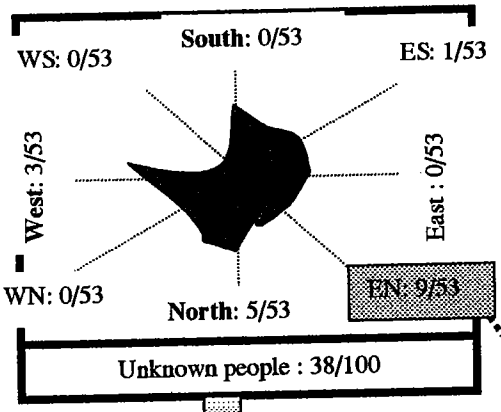
CENSUS OF POPULATION 1995

Number	Total	Population now
Families	113	
Population	732	879

UXO AND ACCIDENT SURVEY, 2001

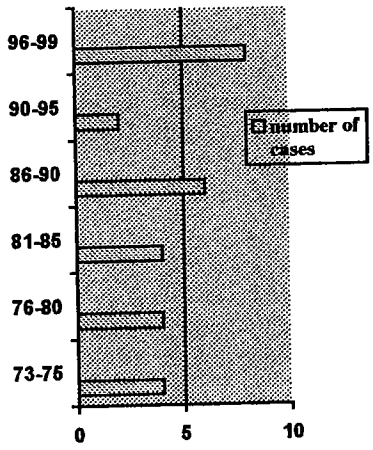
Survey	Number of interviewees
UXO	53 people
UXO accident	28 victims

DIRECTIONS OF CONTAMINATED LOCATION



Unknown people : 38/100

NUMBER OF VICTIMS - YEAR



TYPES OF UXO THE INHABITANT SEE

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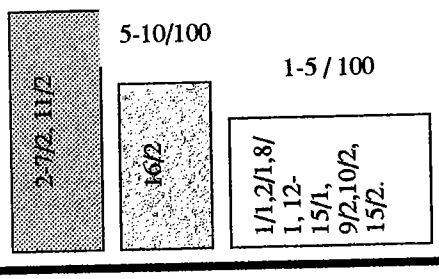
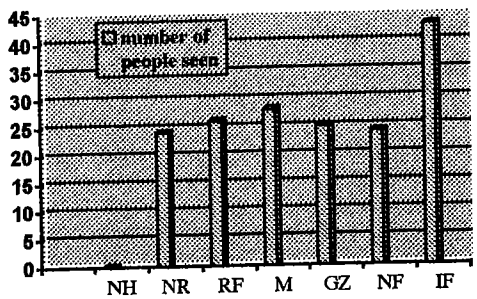
Number of interviewees seen the types of UXO
As following the results of the pictured survey

Number in columm = number of pictue / number of pictured page



LOCATIONS HAVE UXO



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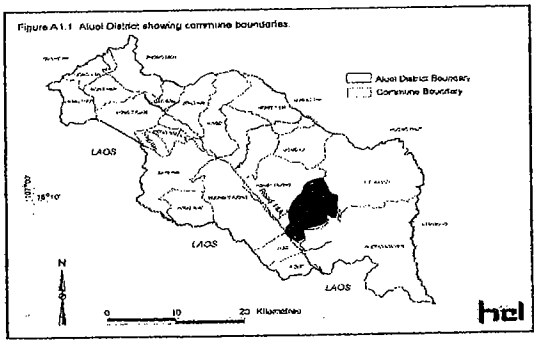


HƯƠNG LÂM COMMUNE

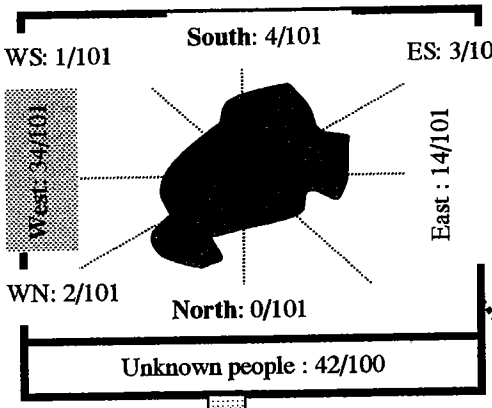
CENSUS OF POPULATION 1995

Number	Tổng số	Population now
Families	225	
population	1.300	1.557

UXO AND ACCIDENT SURVEY, 2001

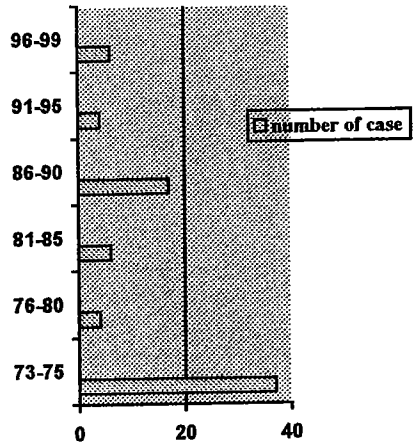
Survey	Number of interviewees
UXO	101 people
UXO accident	68 victims

DIRECTIONS OF CONTAMINATED LOCATION



Unknown people : 42/100

NUMBER OF VICTIMS - YEAR



TYPES OF UXO THE INHABITANT SEE

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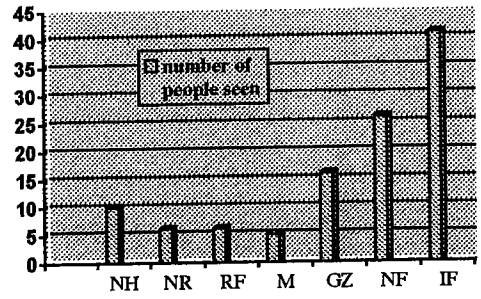
Number in columm = number of pictue / number of pictured page

1-5 / 100

6/1, 6/2, 9/2, 17/2

LOCATIONS HAVE UXO



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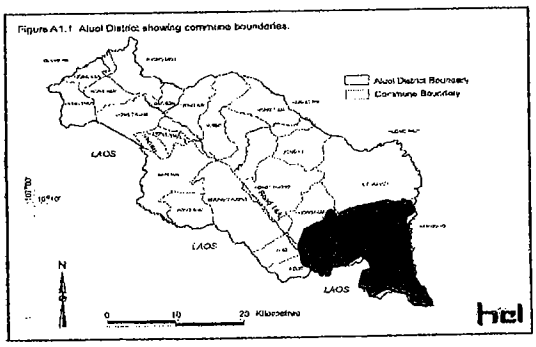


HƯƠNG NGUYÊN COMMUNE

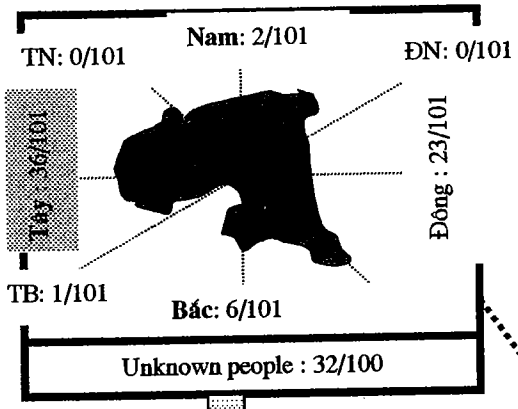
CENSUS OF POPULATION 1995

Number	Total	Poppulation now
Families	140	
Population	880	1.015

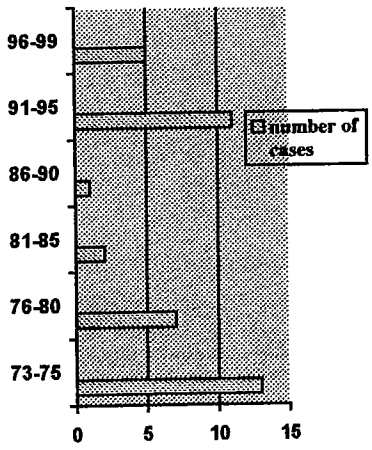
UXO AND ACCIDENT SURVEY, 2001

Survey	Number of interviewees
UXO	101 people
UXO accident	41 victims

DIRECTIONS OF CONTAMINATED LOCATION



NUMBER OF VICTIMS - YEAR



TYPES OF UXO THE INHABITANT SEE

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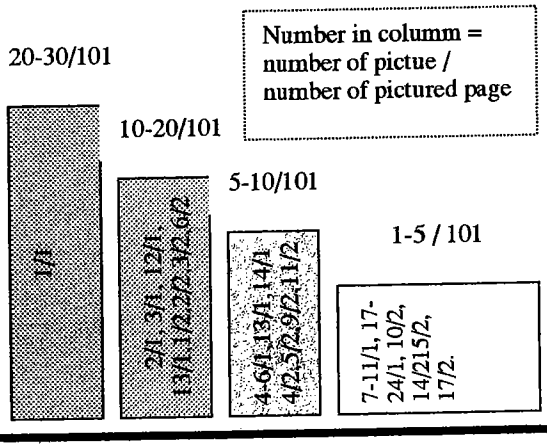
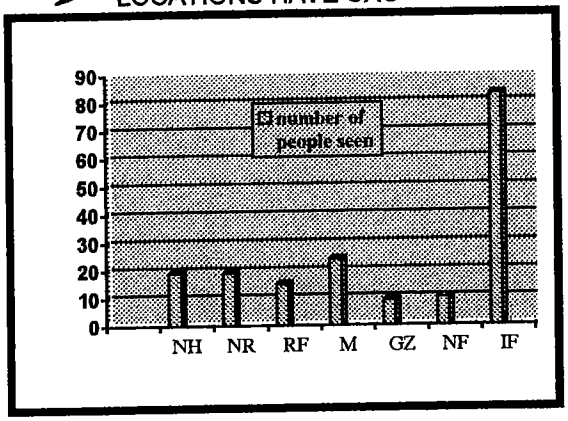
Number of interviewees seen the types of UXO
As following the results of the pictured survey



LOCATIONS HAVE UXO



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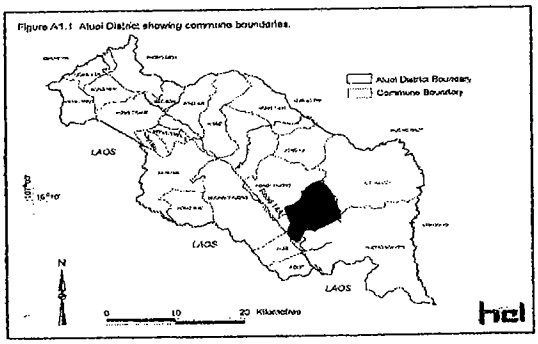


HƯƠNG PHONG COMMUNE

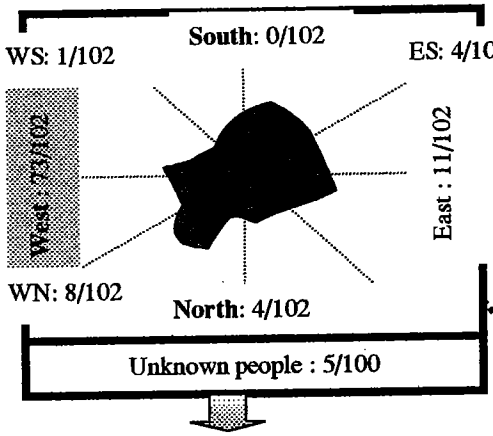
CENSUS OF POPULATION 1995

Number	Total	Population now
Families	56	
Population	287	4.500

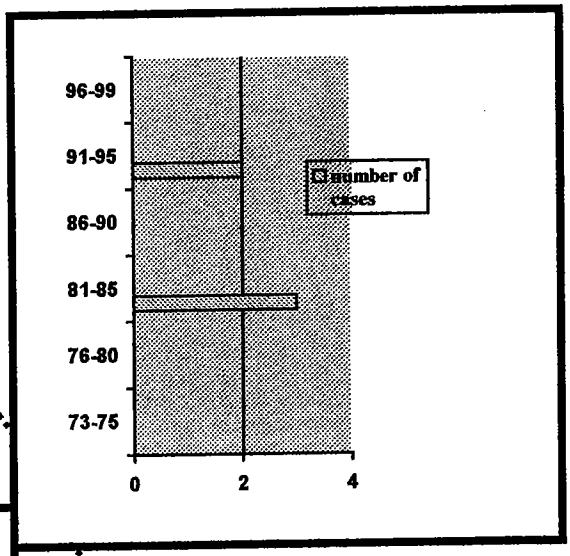
UXO AND ACCIDENT SURVEY, 2001

Survey	Number of interviewees
UXO	102 people
UXO accident	5 victims

DIRECTIONS OF CONTAMINATED LOCATION

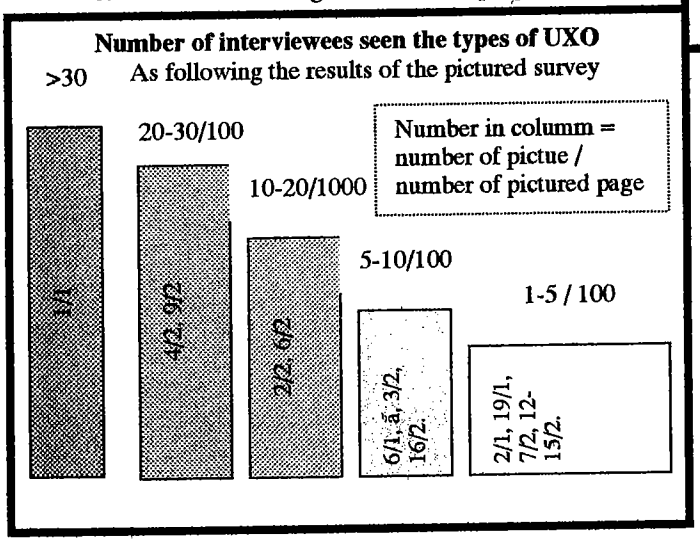


NUMBER OF VICTIMS - YEAR

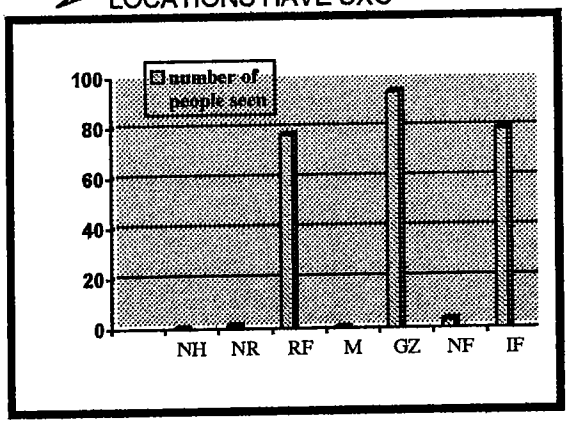


TYPES OF UXO THE INHABITANT SE

Classified as following the number of people seen



LOCATIONS HAVE UXO



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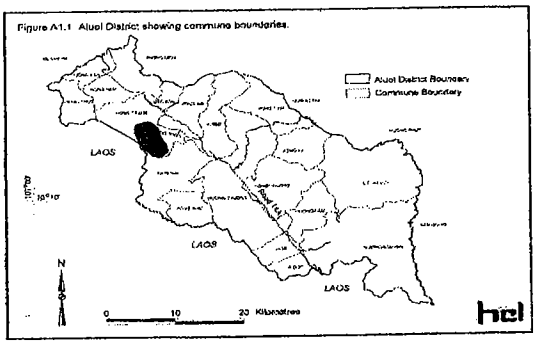


HỒNG BẮC COMMUNE

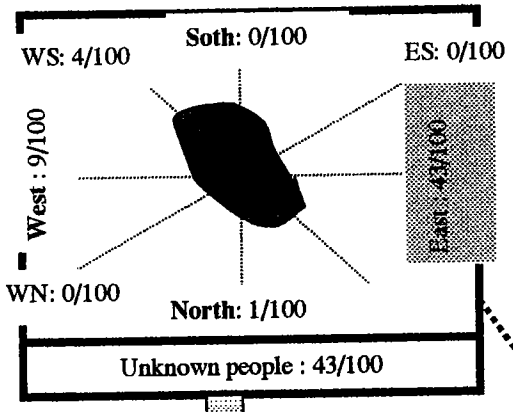
CENSUS OF POPULATION 1995

Number	Total	Population now
Families	241	
Population	1.345	1.608

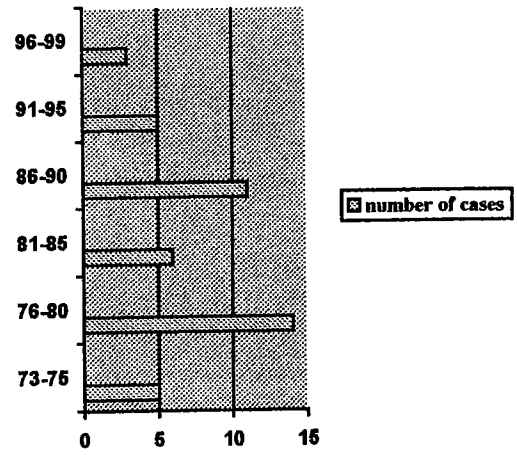
UXO AND ACCIDENT SURVEY, 2001

Survey	Number of interviewees
UXO	100 people
UXO accident	45 victims

DIRECTIONS OF CONTAMINATED LOCATION

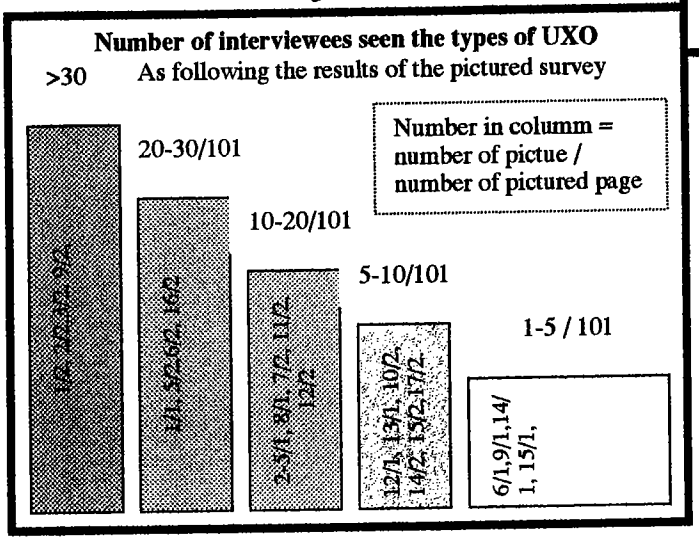


NUMBER OF VICTIMS - YEAR

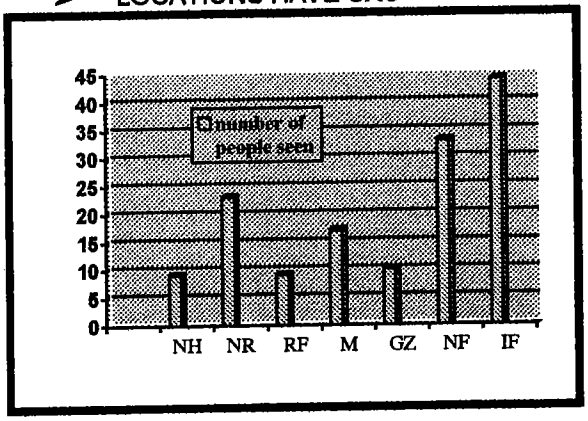


TYPES OF UXO THE INHABITANT SE

Classified as following the number of people seen



LOCATIONS HAVE UXO



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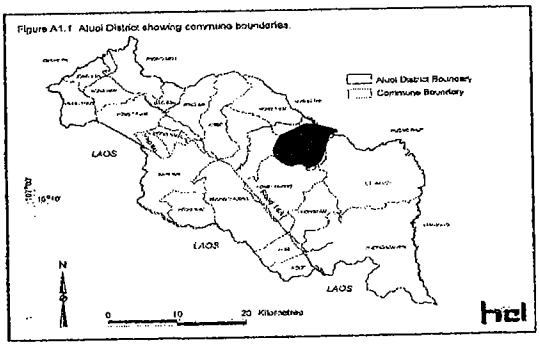


HỒNG HẠ COMMUNE

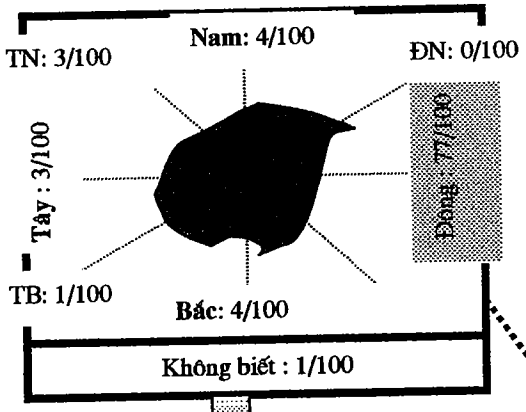
CENSUS OF POPULATION 1995

Number	Total	Population now
Families	154	
Population	1.007	1.198

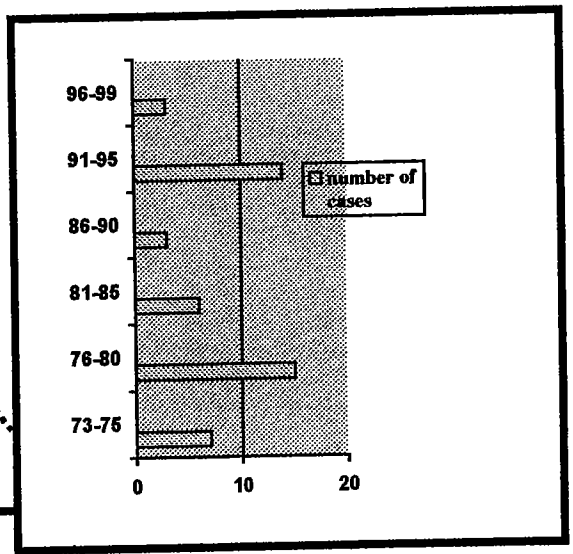
UXO AND ACCIDENT SURVEY, 2001

Survey	Number of interviewees
UXO	100 people
UXO accident	48 victims

DIRECTIONS OF CONTAMINATED LOCATION

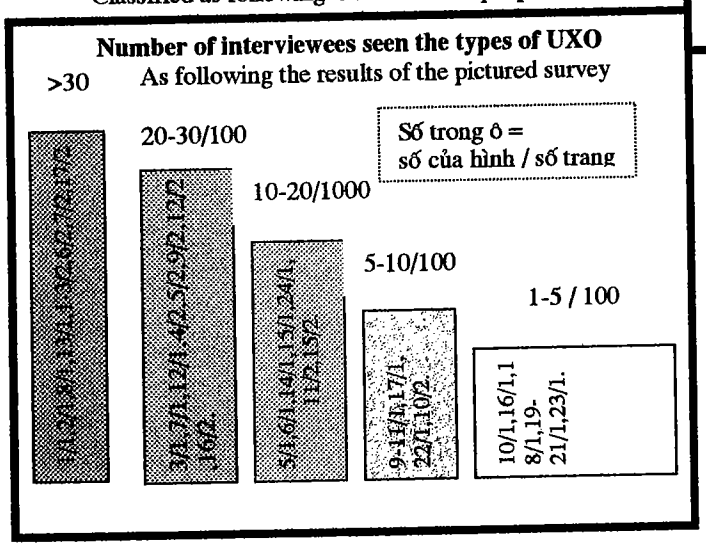


NUMBER OF VICTIMS - YEAR

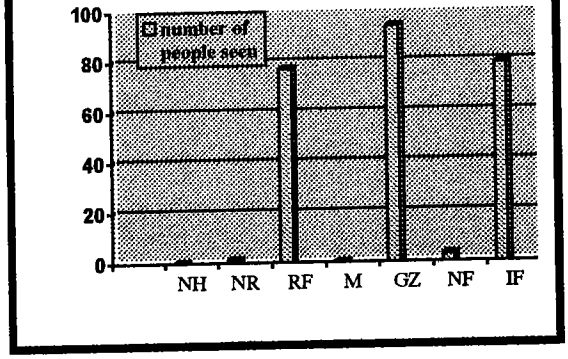


TYPES OF UXO THE INHABITANT SE

Classified as following the number of people seen



LOCATIONS HAVE UXO



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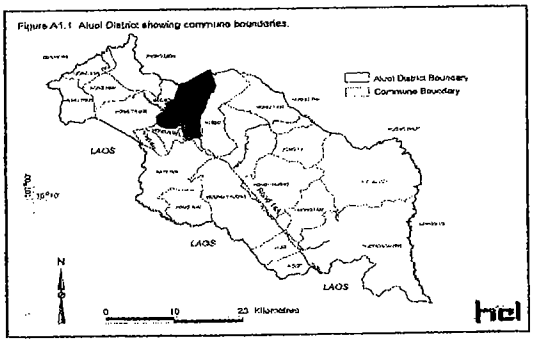


HỒNG KIM COMMUNE

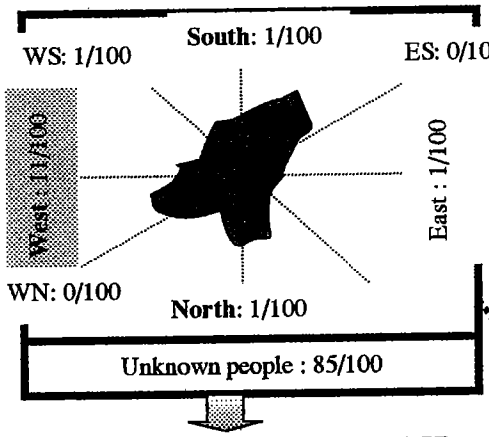
CENSUS OF POPULATION 1995

Number	Total	Population now
Families	213	
Population	1.382	1.485

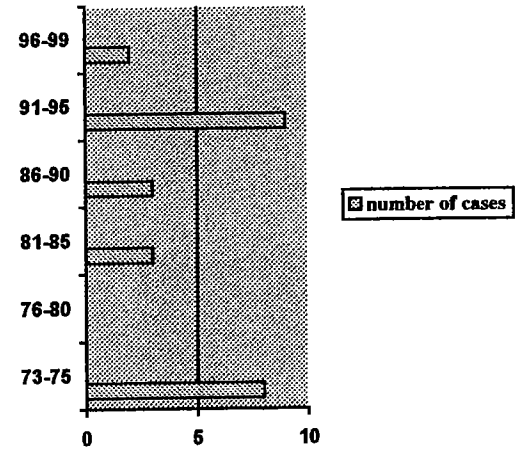
UXO AND ACCIDENT SURVEY, 2001

Survey	Number of interviewees
UXO	100 people
UXO accident	25 victims

DIRECTIONS OF CONTAMINATED LOCATION



NUMBER OF VICTIMS - YEAR



TYPES OF UXO THE INHABITANT SEE

Classified as following the number of people seen

Number of interviewees seen the types of UXO

>30 following the results of the pictured survey

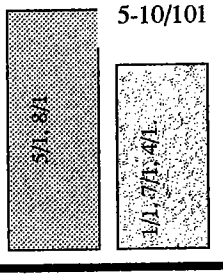
20-30/101

Number in columm = number of pictue / number of pictured page

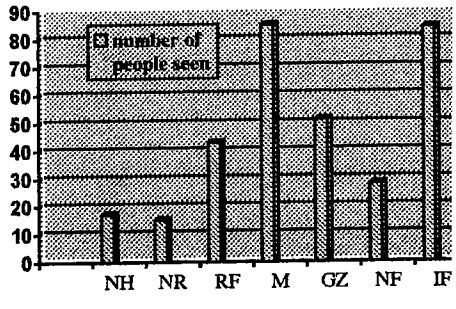
10-20/101

5-10/101

1-5 / 101



LOCATIONS HAVE UXO



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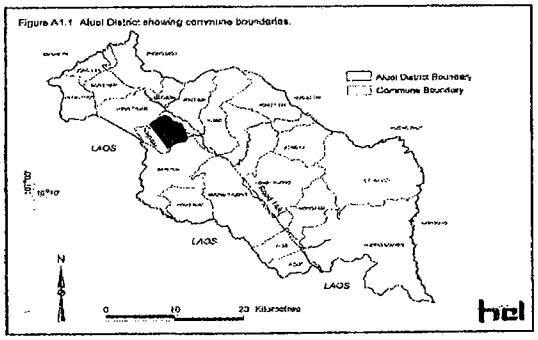


XÃ HỒNG QUẢNG

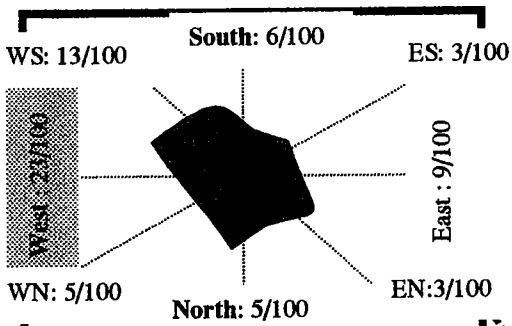
CENSUS OF POPULATION 1995

Number	Total	Population now
Families	254	
Population	1.567	1.689

UXO AND ACCIDENT SURVEY, 2001

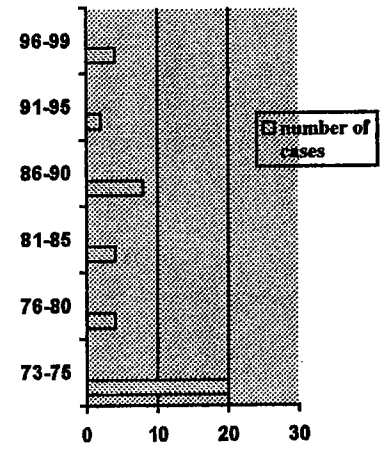
Survey	Number of interviewees
UXO	100
UXO accident	42 victims

DIRECTIONS OF CONTAMINATED LOCATION



Unknown people : 36/100

NUMBER OF VICTIMS - YEAR

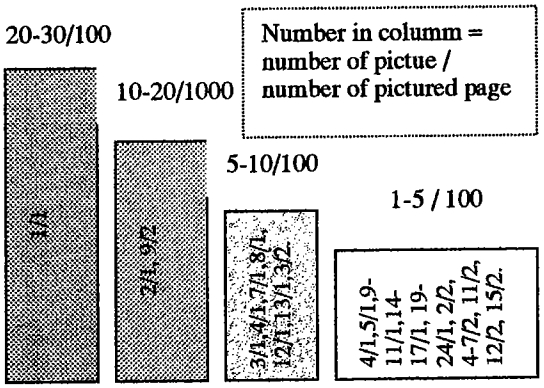


TYPES OF UXO THE INHABITANT SEE

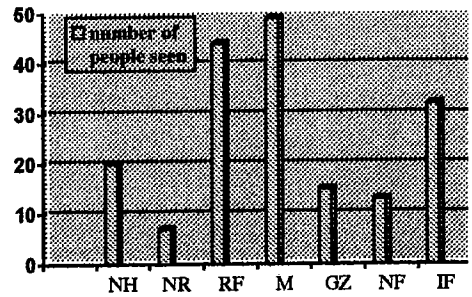
Classified as following the number of people seen

Number of interviewees seen the types of UXO

>30 As following the results of the pictured survey

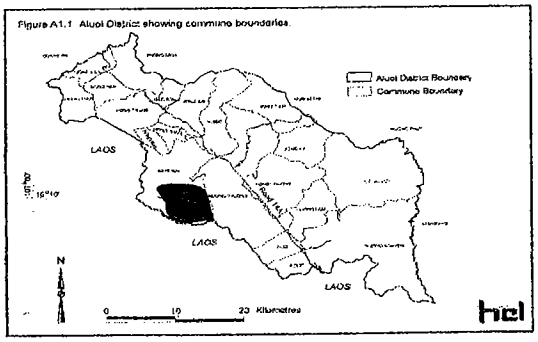


LOCATIONS HAVE UXO



ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY



HỒNG THÁI COMMUNE

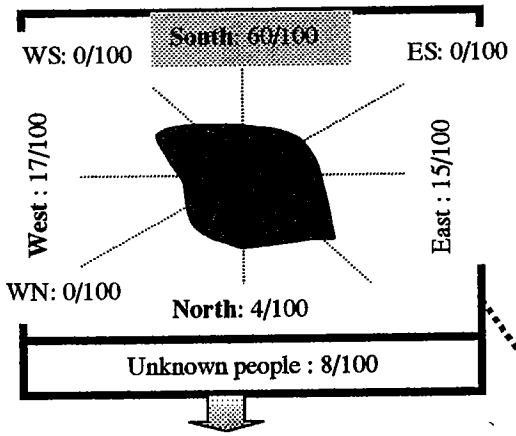
CENSUS OF POPULATION 1995

Number	Total	Population now
Families	154	
Population	945	1.760

UXO AND ACCIDENT SURVEY, 2001

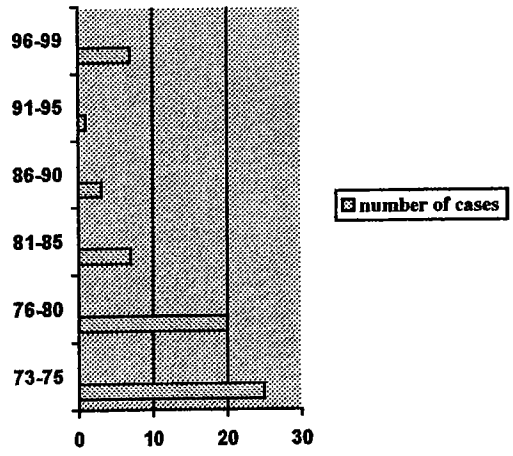
Survey	Number of interviewees
UXO	100 people
UXO accident	62 victims

DIRECTIONS OF CONTAMINATED LOCATION



Unknown people : 8/100

NUMBER OF VICTIMS - YEAR



TYPES OF UXO THE INHABITANT SEE

Classified as following the number of people seen

Number of interviewees seen the types of UXO

>30 As following the results of the pictured survey

20-30/101

10-20/101

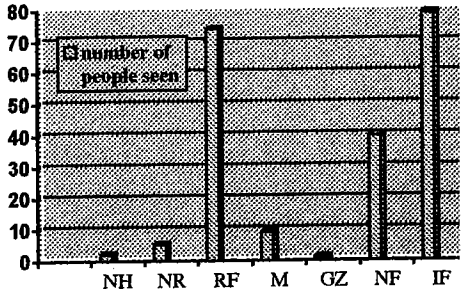
5-10/101

1-5 / 101

Number in columm = number of pictue / number of pictured page

1/1, 2/1, 7/1, 9/2.

LOCATIONS HAVE UXO



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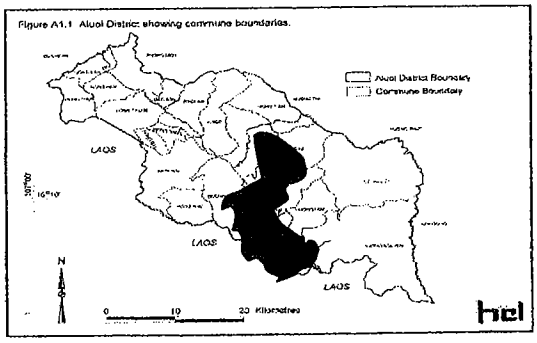
SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY



HỒNG THƯỢNG COMMUNE

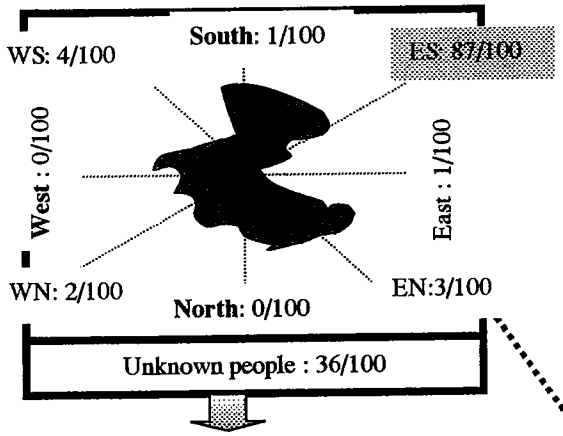
CENSUS OF POPULATION 1995

Number	Total	Population now
Families	269	
Population	1.504	1.760

UXO AND ACCIDENT SURVEY, 2001

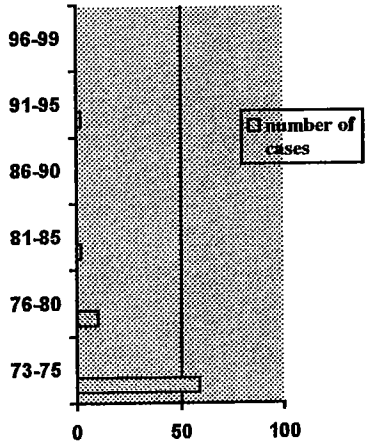
Survey	Number of interviewees
UXO	100 people
UXO accident	73 victims

DIRECTIONS OF CONTAMINATED LOCATION



Unknown people : 36/100

NUMBER OF VICTIMS - YEAR

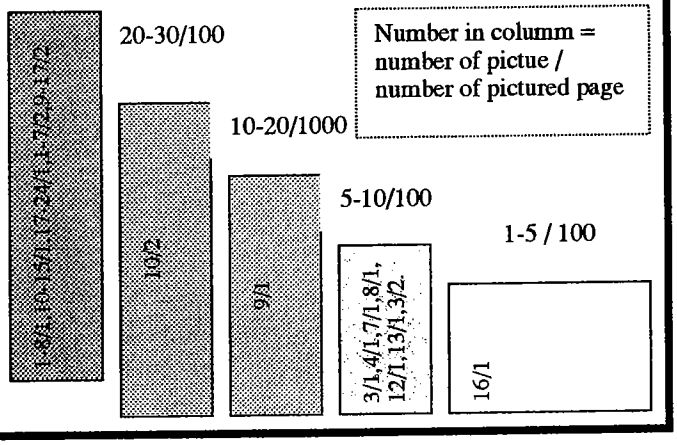


TYPES OF UXO THE INHABITANT SEE

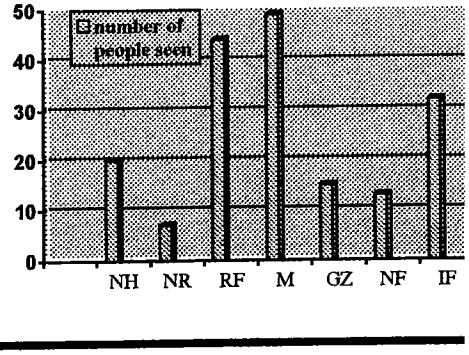
Classified as following the number of people seen

Number of interviewees seen the types of UXO

>30 As following the results of the pictured survey



LOCATIONS HAVE UXO



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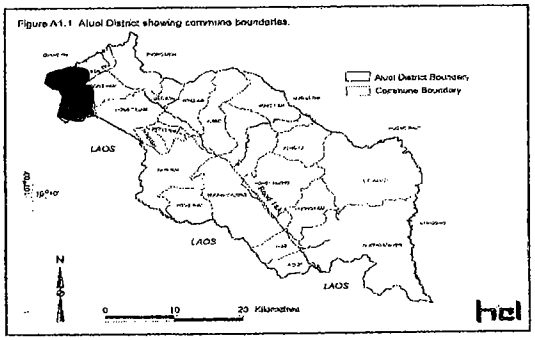


HỒNG THỦY COMMUNE

CENSUS OF POPULATION 1995

Number	Total	Population now
Families	304	
Population	1.796	

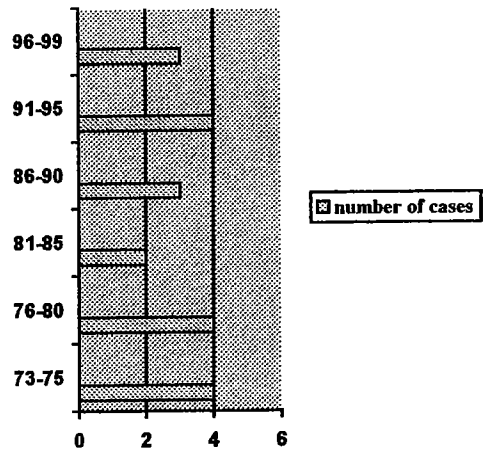
UXO AND ACCIDENT SURVEY, 2001

Survey	Number of interviewees
UXO	100 people
UXO accident	25 victims

DIRECTIONS OF CONTAMINATED LOCATION

South: 9/100
WS: 0/100
ES: 0/100
West: 16/100
East : 49/100
WN: 0/100
North: 20/100
Unknown people : 6/100

NUMBER OF VICTIMS - YEAR



TYPES OF UXO THE INHABITANT SEE

Classified as following the number of people seen

Number of interviewees seen the types of UXO

.s following the results of the pictured survey

>30

20-30/100

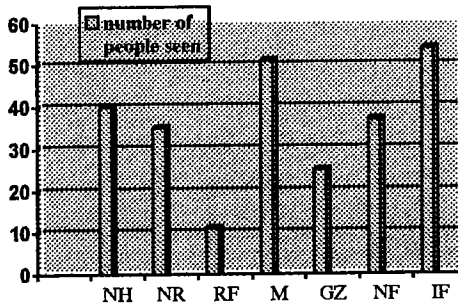
10-20/100

5-10/100

1-5 / 100

Number in columm = number of pictue / number of pictured page

LOCATIONS HAVE UXO



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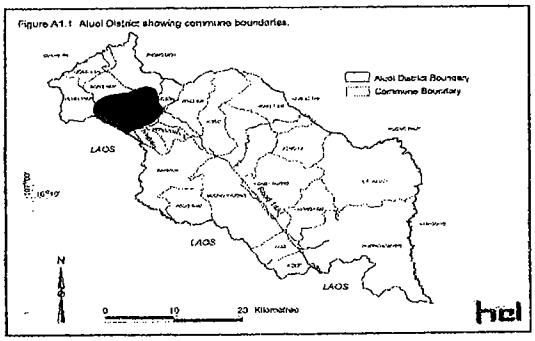


HỒNG TRUNG COMMUNE

CENSUS OF POPULATION 1995

Number	Total	Population now
Families	205	
Population	1.215	

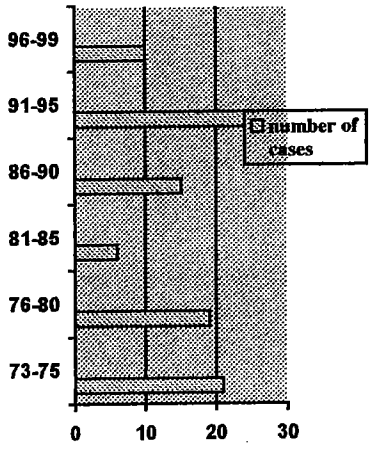
UXO AND ACCIDENT SURVEY, 2001

Survey	Number of interviewees
UXO	100 people
UXO accident	95 victims

DIRECTIONS OF CONTAMINATED LOCATION

South: 19/100
WS: 3/100
ES: 1/100
West : 11/100
East : 9/100
WN: 0/100
EN:0/100
North: 37/100
Unknown people : 20/100

NUMBER OF VICTIMS - YEAR



TYPES OF UXO THE INHABITANT SEE

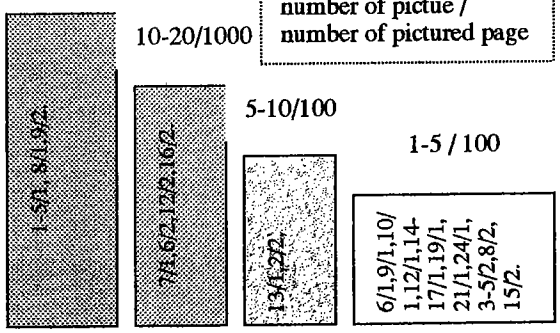
Classified as following the number of people seen

Number of interviewees seen the types of UXO

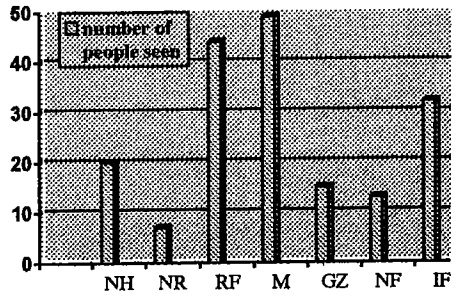
>30 As following the results of the pictured survey

20-30/100
10-20/1000
5-10/100
1-5 / 100

Number in columm = number of pictue / number of pictured page



LOCATIONS HAVE UXO



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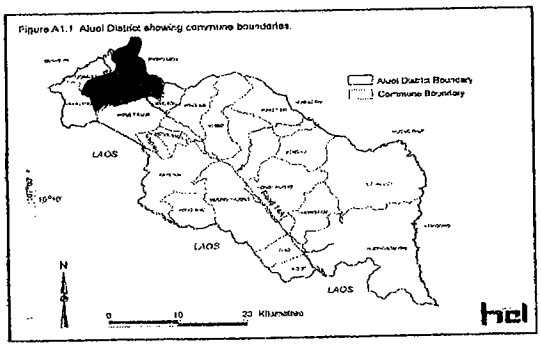


HỒNG VÂN COMMUNE

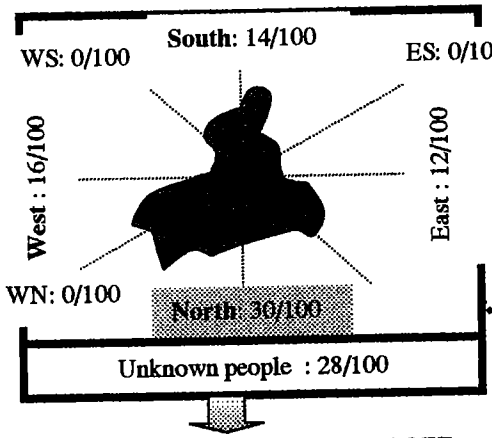
CENSUS OF POPULATION 1995

Number	Total	Population now
Families	278	
Population	1.675	2.183

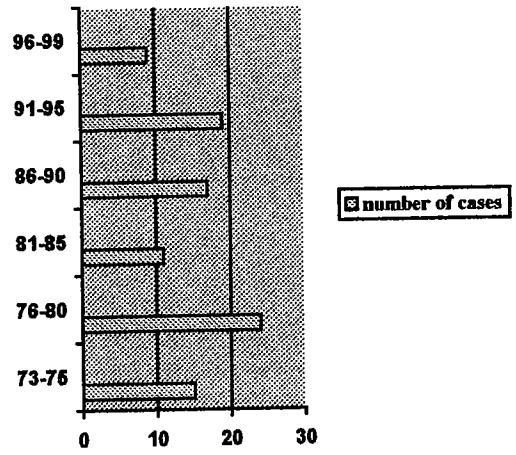
UXO AND ACCIDENT SURVEY, 2001

Survey	Number of interviewees
UXO	100 people
UXO accident	95 victims

DIRECTIONS OF CONTAMINATED LOCATION



NUMBER OF VICTIMS - YEAR



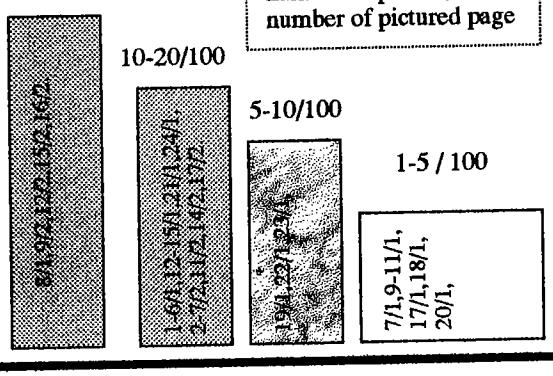
TYPES OF UXO THE INHABITANT SEE

Classified as following the number of people seen

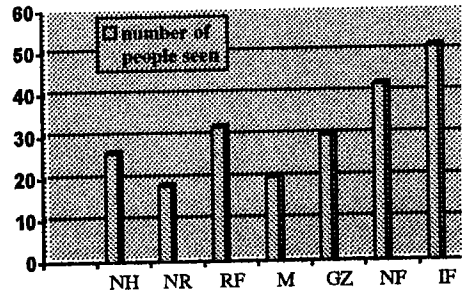
Number of interviewees seen the types of UXO

>30 .s following the results of the pictured survey

Number in columm = number of pictue / number of pictured page



LOCATIONS HAVE UXO



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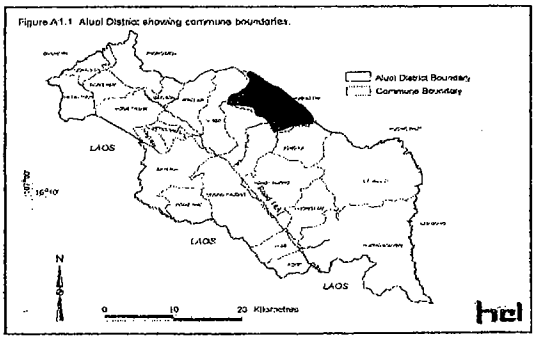


PHÚ VINH COMMUNE

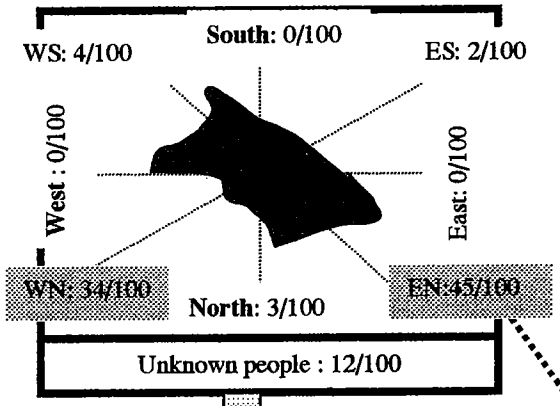
CENSUS OF POPULATION 1995

Number	Total	Population
Families	157	now
Population	900	913

UXO AND ACCIDENT SURVEY, 2001

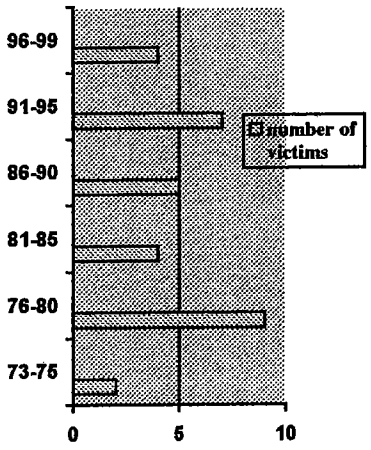
Survey	Number of interviewees
UXO	100 people
UXO accident	31 victims

DIRECTIONS OF CONTAMINATED LOCATION



Unknown people : 12/100

NUMBER OF VICTIMS - YEAR



TYPES OF UXO THE INHABITANT SEE

Classified as following the number of people seen

Number of interviewees seen the types of UXO

>30 As following the results of the pictured survey

20-30/100

10-20/1000

Number in columm = number of pictue / number of pictured page

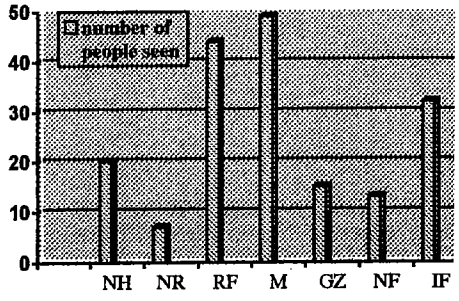
5-10/100

8/1,12/1,13/1.

1-5 / 100

1-3/1, 24/1, 1/2,2/2, 4-7/2, 12/2, 17/2.

LOCATIONS HAVE UXO



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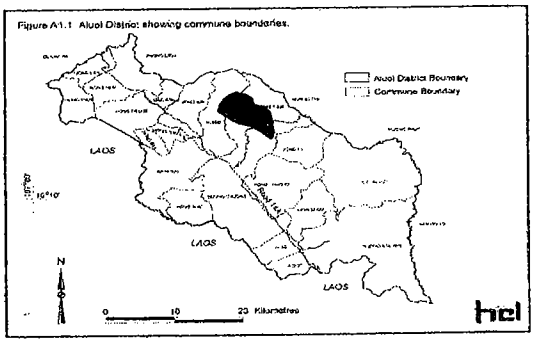


SƠN THỦY COMMUNE

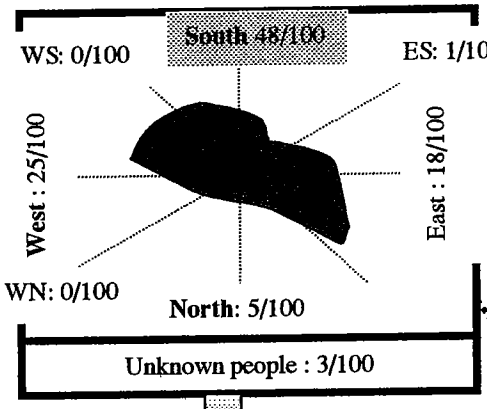
CENSUS OF POPULATION 1995

Number	Total	Population now
Families	697	
Population	3.563	

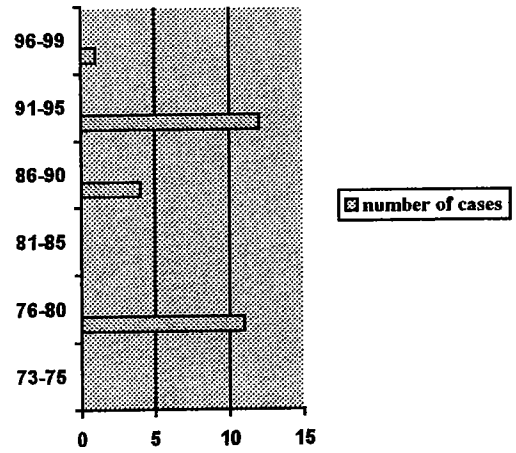
UXO AND ACCIDENT SURVEY, 2001

Survey	Number of interviewees
UXO	100 people
UXO accident	28 victims

DIRECTIONS OF CONTAMINATED LOCATION

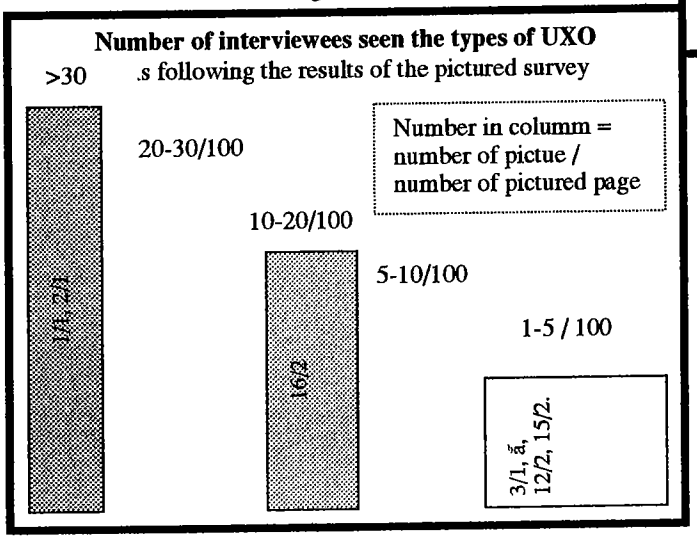


NUMBER OF VICTIMS - YEAR

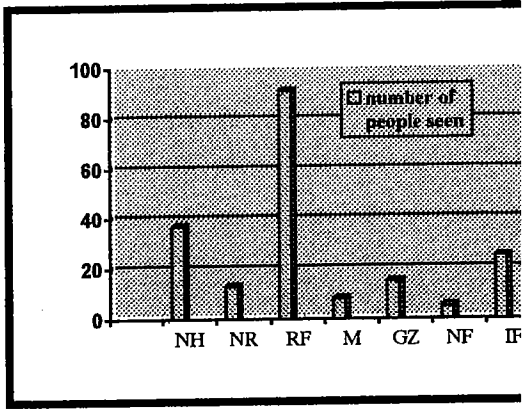


TYPES OF UXO THE INHABITANT SEE

Classified as following the number of people seen



LOCATIONS HAVE UXO



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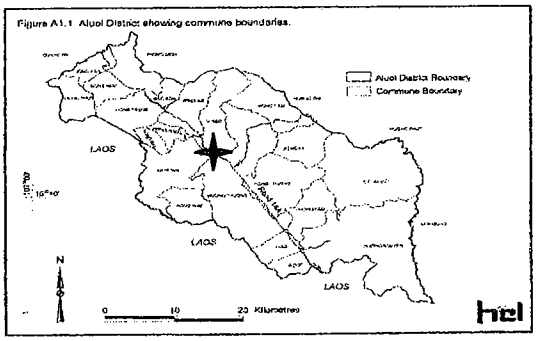


A LƯỚI TOWN

CENSUS OF POPULATION 1995

Number	Total	Population now
Families		
Population		

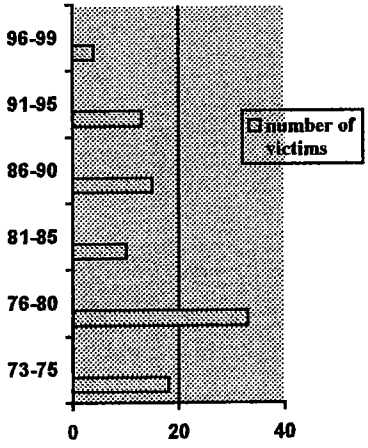
UXO AND ACCIDENT SURVEY, 2001

Survey	Number of interviewees
UXO	100 people
UXO accident	93 victims

DIRECTIONS OF CONTAMINATED LOCATION

South: 13/100
WS: 4/100
ES: 0/100
West : 15/100
East : 2/100
WN: 2/100
EN:0/100
North: 28/100
Unknown people : 20/100

NUMBER OF VICTIMS - YEAR



TYPES OF UXO THE INHABITANT SEE

Classified as following the number of people seen

Number of interviewees seen the types of UXO

>30 As following the results of the pictured survey

20-30/100

10-20/1000

5-10/100

1-5 / 100

Number in columm = number of pictue / number of pictured page

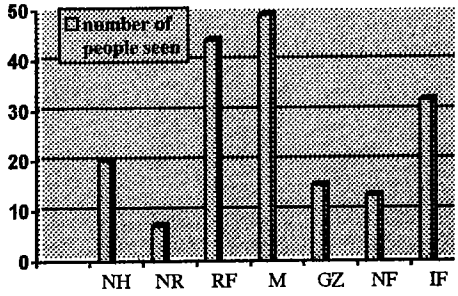
1/1,2/1,

3/1,4/1,13/1,7/2

5/1,8/1,19/1,24/1,3/2,6/2,16/2

6/1,9/1,11/1,12/1,14/1,15/1,17/1,18/1,21-23/1,1/2,2/2,4/2,9/2...

LOCATION HAVE UXO



ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

THE NAME LIST OF UXO VICTIMS IN A LUOI.

Legend:
Nữ = Female S = alive
Nam = Male C = died

I. A ĐỚT COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	KAN MANH	21	Nữ	S
2	DROP ZIP	91	Nam	C
3	VAN SINH	92	Nữ	C
4	KAN OT	41	Nữ	S
5	KAN TIEP	56	Nữ	S
6	BLUP KIM	65	Nữ	S
7	KA RIENG PRI	69	Nam	S
8	HO VAN DAM	38	Nam	S
9	RA PAT RAO	87	Nam	C
10	KAN PU	41	Nữ	S
11	CU LIENG	81	Nam	C
12	VIEN THI TIU	94	Nữ	S
13	BLUP VA		Nam	C
14	VIEN XUAN O	79	Nam	C
15	HO VAN THUOC	76	Nam	S
16	HO THI BON	51	Nữ	S
17	A VIET THI BIU	51	Nữ	S
18	HO VAN HUCH	75	Nam	S
19	A VIET DAY	71	Nam	S
20	HO VAN DUC	83	Nam	S
21	HO VAN DIU	46	Nam	S
22	LE HOA LY		Nam	C
23	A LEN	86	Nam	S
24	HO VAN BOI	58	Nam	S
25	QUYNH BON	21	Nam	S
26	HO VAN NON	36	Nam	S
27	RA PAT MOAL		Nam	C
28	CU BANG	41	Nam	S
29	QUYNH LAP		Nam	C
30	CAN ZOM	21	Nữ	S
31	CAI	51	Nữ	S
32	CU DONG		Nam	C
33	A VIET DUNG		Nam	C
34	CAN NHUOI	53	Nữ	S
35	HO THI NGU	57	Nữ	S
36	QUYNH MO	48	Nam	S
37	QUYNH HONG	49	Nam	S
38	HO VAN MANH	60	Nam	S
39	LE T.QUANG	63	Nam	S
40	LE HONG VUA	76	Nam	S
41	LE VAN LIEM		Nam	C
42	A VIET CLAY	73	Nam	S
43	CU THOI		Nam	C
44	NGUYEN VAN TRAN		Nam	C
45	NGUYEN VAN BOI	76	Nam	S
46	CAN THUA		Nữ	S
47	LE HONG TREO	52	Nam	S
48	LE HONG LONG	94	Nam	S
49	HO VAN NGOAN	85	Nam	S
50	VIEM HAI XE	54	Nam	S
51	CAN NHA	65	Nữ	S
52	CAN KICH		Nữ	S
53	A VIET NHA	65	Nam	S
54	LE VIET NAM		Nam	C
55	CAN A	64	Nữ	S
56	VIEN XUAN MAC	89	Nam	S
57	HO XUAN CAI	46	Nam	S
58	HO VAN MUON		Nam	C
59	RA PAT DO	94	Nam	S
60	CU BAO		Nam	C
61	QUYNH MAI		Nam	C
62	XIENG	56	Nam	S
63	CU VUA	59	Nam	S
64	CAN COC	41	Nữ	S
65	KAN A VOL	51	Nữ	S
66	CAN DAN	61	Nữ	S
67	CAN DOL	41	Nữ	S
68	TRAN VAN LOC	59	Nam	S
69	PHAM VAN LUONG	36	Nam	S
70	KAN THANG	43	Nữ	S
71	RA PAT NHI BE	85	Nữ	S
72	QUYNH MIEU	31	Nam	S
73	RA PAT HUNG	62	Nam	S
74	QUYNH NHO	56	Nam	S
75	DANG VAN LOI	60	Nam	S

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

N	Name	Date of birth	Sex	Died - Alive
76	PLING DOI	61	Nam	S
77	HO VAN DANH	39	Nam	S
78	RA PAT BINH	75	Nam	S
79	QUYNH NHAP	38	Nam	S
80	CU CHIEN	81	Nam	C
81	NGUYEN THI TRAN	86	Nữ	C
82	LIEM	86	Nam	C
83	KAN PAS	64	Nữ	C
84	RA PAT RAC	88	Nam	C
85	CU RE	41	Nam	S
86	LE TUYEN QUANG	61	Nam	S
87	RA PAT TUNG	64	Nam	S
88	KAN THIET	60	Nữ	S
89	KAN O	78	Nữ	C

II. A NGO COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	CAN DUA	32	Nữ	S
2	KA RIENG MIEN	54	Nam	S
3	QUYNH HAI	32	Nam	S
4	A KIENG BE	67	Nam	S
5	QUYNH DUA	32	Nam	S
6	CU CHIEN	65	Nam	S
7	NGO SY THANH	63	Nam	S
8	PHAM V. NGOT	62	Nam	S
9	QUYNH XEN	31	Nam	S
10	CU PINH	63	Nam	S
11	HO VAN NHI	82	Nam	S
12	QUYNH HO	70	Nam	C
13	KAN HA	45	Nữ	S
14	CU LAR	64	Nam	S
15	CU HANG	55	Nam	S
16	PA TA NINH	71	Nam	C
17	KAH LAT	52	Nữ	S
18	HO VAN TUONG	40	Nam	S
19	HO VAN XUOM	35	Nam	S
20	PHAM H. YEN	73	Nữ	S
21	PI RIU BA	81	Nam	S
22	QUYNH HINH	52	Nam	S
23	LE THI NEL	42	Nữ	S
24	KE THI LAT	75	Nữ	S
25	QUYNH LIEN	34	Nam	S
26	QUYNH HUA	34	Nam	S
27	QUYNH NGAM	41	Nam	C
28	HO VAN THAN	55	Nam	S
29	HO VAN KHE	71	Nam	S
30	QUYNH NHUA	68	Nam	S
31	KAN OR	43	Nữ	S
32	CA MOL	36	Nữ	S
33	QUYNH HIEN	36	Nam	S
34	KA PHO	42	Nữ	S
35	PHAM THI LE	59	Nữ	S
36	QUYNH NUOC	34	Nam	S
37	DAO MINH CHAM	70	Nam	S
38	PI RIU NGUONG	74	Nam	S
39	KAN MUOI	33	Nữ	S
40	NHUI	40	Nam	S
41	KAN DIET	52	Nữ	S
42	KEER XUAN TEP	66	Nam	S
43	KER DUC DAP	65	Nam	S
44	KEN ET	36	Nữ	S
45	HO VAN LAM	79	Nam	S
46	QUYNH NY	21	Nam	S
47	QUYNH NGHECH	41	Nam	C
48	HO XUAN MIENG	73	Nam	C
49	DOAN VAN LOT	83	Nam	C
50	QUYNH PUN	51	Nam	C
51	KAN RUOU	83	Nữ	C
52	DOAN MINH NGAM	89	Nam	C
53	CU XIA	87	Nam	C
54	CU LEP	41	Nam	C
55	KAN NGHECH	41	Nữ	C
56	KAN CHENG	31	Nữ	C
57	QUYNH DIET	35	Nam	S
58	QUYNH NHU	51	Nam	S
59	KAN ME	48	Nữ	S
60	HO VAN NHAT	31	Nam	S
61	QUYNH NOP	41	Nam	C

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

N	Name	Date of birth	Sex	Died - Alive
62	KAN LINH	38	Nữ	S
63	KAN HAM	46	Nữ	S
64	QUYNH VUNG	67	Nam	S
65	QUYNH BE	42	Nam	S
66	PI RIU VOI	72	Nam	S
67	QUYNH BUA	53	1	1

III. A ROÀNG COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	QUYNH MIT	41	Nam	S
2	QUYNH TIA	56	Nam	S
3	QUYNH DAP	46	Nam	S
4	QUYNH SUI	79	Nam	S
5	QUYNH MER	51	Nam	S
6	KAN TIEP	71	Nữ	S
7	VIEN DANG MINH	63	Nam	S
8	QUYNH NEP	47	Nam	S
9	QUYNH DO	41	Nam	S
10	KAN NHIT	53	Nữ	S
11	BLUP TUNG	71	Nam	S
12	QUYNH POOC	31	Nam	S
13	KAN DOT	26	Nữ	S
14	QUYNH TRI	41	Nam	S
15	QUYNH NHAP	26	Nam	S
16	QUYNH DANG	63	Nam	S
17	A VO SO	31	Nam	S
18	KAN PRAM	26	Nữ	S
19	QUYNH NHIT	39	Nam	S
20	QUYNH HUT	51	Nam	S
21	HO XUAN BEN	46	Nam	S
22	QUANH CHIEN	61	Nam	C
23	QUYNH KAY	36	Nam	S
24	VIEN A MUONG	76	Nam	C
25	VIEN XUAN DIEU	59	Nam	C
26	VIEN XUAN IT	81	Nam	C
27	QUYNH CO		Nam	C
28	HO VIET HE	50	Nam	S
29	QUYNH VINH	45	Nam	S
30	VIEN X. NU	74	Nam	S
31	KE DIEN NHIT	90	Nam	S
32	A VIET CAO	76	Nam	S
33	BLUP THI LUT	16	Nữ	S
34	QUANH THOM	56	Nam	S
35	PO LOONG HOP	74	Nam	S
36	BLUP PHINH	76	Nam	C
37	PO LOONG HO	94	Nam	C
38	KAN HAI	64	Nữ	C
39	KAN LA	71	Nữ	C
40	QUYNH A UM	45	Nam	S
41	QUYNH LOAN	63	Nam	S
42	QUYNH ROM	71	Nam	C
43	KAN AN	47	Nữ	S
44	KE VAN LOI	79	Nam	S
45	QUYNH HUT	53	Nam	S
46	QUYNH BIEN	71	Nam	S
47	KAN PHEO	29	Nữ	S
48	QUYNH THIU	61	Nam	S
49	QUYNH LIEU	70	Nam	S
50	KAN TONH	55	Nữ	C
51	A VO NGOM	73	Nam	S
52	QUYNH NEP	56	Nam	S

IV. A SO - ĐÔNG SƠN COMM.

N	Name	Date of birth	Sex	Died - Alive
1	TRAN VAN HAI		Nam	C
2	A HUOP	83	Nữ	C
3	KAN THON	51	Nữ	S
4	A RE	72	Nam	S
5	HO VAN E	74	Nam	S
6	HO VAN THIEN	74	Nam	S
7	HO VAN DAY	61	Nam	S
8	HO VAN BIN	78	Nam	S
9	QUYNH SON	29	Nam	S
10	QUYNH TOAN	42	Nam	S
11	HO XUAN PI	62	Nam	S
12	KAN XA	21	Nữ	S
13	NGUYEN VAN NGHIEN	83	Nam	S
14	HO XUAN KHENG	76	Nam	C
15	HO XUAN PIN	70	Nam	C

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

N	Name	Date of birth	Sex	Died - Alive
16	HO VAN PHIEN	96	Nam	C
17	TU VOI	63	Nam	S
18	KAN PHA	63	Nữ	S
19	KAN XEM	55	Nữ	S
20	QUYNH XENH	35	Nam	S
21	QUYNH NGAN	34	Nam	S
22	KAN SUA	41	Nữ	S
23	KAN THONG	36	Nữ	S
24	HO THI KHUA	66	Nữ	S
25	KAN MIEN	26	Nữ	S
26	KAN ON	65	Nữ	S
27	CU RAI	81	Nam	C
28	KAN MUA	56	Nữ	C
29	HO VAN HENG	74	Nam	S
30	NGUYEN VAN DUNG	46	Nam	S
31	KAN VE		Nữ	S
32	HO THI TAM	73	Nữ	S
33	HO VAN TEM	39	Nam	S
34	HO VAN CHOI	89	Nam	C
35	KAN HAI	70	Nữ	S
36	A VIET PHO	84	Nam	S
37	QUYNH PHAT	41	Nam	S
38	KAN NGANG	46	Nữ	S
39	HO VAN DU	44	Nam	S
40	HO VAN LE	81	Nam	S
41	KAN XUA	69	Nữ	S
42	A NANG	91	Nam	S
43	QUYNH HACH	21	Nam	S
44	KAN OAN	47	Nữ	S
45	NGUYEN V.THI	75	Nam	S
46	QUYNH DIEP	74	Nam	S
47	KAN A DAP	70	Nam	S
48	KAN VEN	51	Nữ	S
49	KAN MINH	32	Nữ	S
50	QUYNH NGHIEM	31	Nam	S
51	QUYNH HEM	39	Nam	S
52	QUYNH TE	63	Nam	S
53	HO VAN CA	91	Nam	C
54	HO XUAN PIN	70	Nam	C

V. BẮC SƠN COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	QUYNH DI	30	Nam	C
2	HO VAN MAI	70	Nam	C
3	QUYNH HAI	47	Nam	S
4	HO VAN HONG	75	Nam	C
5	QUYNH KHOM	31	Nam	S
6	QUYNH THE	47	Nam	S
7	LE THAN KHUOI	77	Nam	S
8	HO THI SUONG	88	Nữ	S
9	HO THAN TENG	69	Nam	S
10	HO VAN BE	73	Nam	S
11	LE CU POI	65	Nam	S
12	KA THIEN	34	Nữ	S
13	LE QUANG THAI	57	Nam	C
14	CU DOM	70	Nam	S
15	HO VAN HUI	79	Nam	C
16	HO VAN DOI	35	Nam	S
17	HO THI DI	62	Nữ	C
18	QUYNH THOAN	62	Nam	S
19	KAN HUYNH	50	Nữ	S
20	LE THI XUONG	17	Nữ	S
21	QUYNH DIEU	58	Nam	S
22	HO VAN BOI	74	Nam	S
23	HO VAN HUI	78	Nam	C
24	HO VAN DAN	78	Nam	C
25	HO VAN NI	57	Nam	C
26	LE THI DAT	63	Nữ	C
27	HO VAN HANH	63	Nam	C
28	CU LIEN	45	Nam	C

VI. HƯƠNG LÂM COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	A VUI		Nữ	C
2	TRAN THI DOA		Nữ	C
3	HO VAN MACH	61	Nam	S
4	KAN HA	68	Nữ	S
5	A TING DIEN		Nam	C

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

N	Name	Date of birth	Sex	Died - Alive
6	HO VAN LUONG		Nam	C
7	RA PAT TROI	68	Nam	S
8	NGUYEN VAN TUNG	74	Nam	S
9	LE MINH TRAN	62	Nam	S
10	NGUYEN KIM TON	51	Nữ	S
11	HO THI HINH	51	Nữ	S
12	KAN DUONG	56	Nữ	S
13	KAN HA	43	Nữ	S
14	HO THI PHAN		Nữ	C
15	HO DUC THAI		Nữ	C
16	NGUYEN VAN LAP	87	Nam	S
17	CAO MINH TIEP	62	Nam	S
18	TRAN VAN PHUONG		Nam	S
19	KAN TREN	41	Nữ	S
20	QUANH		Nam	C
21	QUANH A VON	14	Nam	S
22	HO VI	40	Nam	S
23	KAN COT		Nữ	C
24	HO THI LAN		Nữ	C
25	HO DUC HANH	78	Nam	S
26	HO THI LUONG		Nữ	C
27	LE MINH TRANG	82	Nam	C
28	KAN CHUI		Nữ	C
29	LE CHIEN		Nam	C
30	HO VAN HA	61	Nam	S
31	KAN TRO		Nữ	C
32	HO VAN HOAN		Nam	S
33	HO VAN NGHIEP	54	Nam	S
34	QUANH TY		Nam	C
35	LE MINH TA		Nam	C
36	LE VAN TY		Nam	C
37	HO XUAN CHI	71	Nam	S
38	LE VAN HAO	46	Nam	S
39	LE KIM THI	49	Nữ	S
40	HO XUAN BO		Nam	C
41	QUANH CHIEN	54	Nam	S
42	HO VAN TRA		Nam	C
43	KAN VOI	61	Nữ	S
44	QUANH CANG		Nam	S
45	KAN TEM	51	Nữ	S
46	QUANH THUY	52	Nam	S
47	KAN CUC	70	Nữ	S
48	LE THI TAM	57	Nữ	S
49	VUONG QUOC THONG	67	Nam	S
50	KAN HAI	31	Nữ	S
51	NGUYEN VAN THO	71	Nam	S
52	TRAN THI KHIM		Nữ	C
53	TRAN VAN KHIEU	77	Nam	S
54	LE MINH HAT		Nam	C
55	KAN HANH		Nữ	C
56	TRAN VAN TIM	51	Nam	S
57	TRAN VAN THAM	78	Nam	S
58	MUON		Nữ	C
59	PHAM XUAN HUYET	81	Nam	S
60	NGUYEN THI BOI		Nữ	C
61	PHAM XUAN HUU	73	Nam	S
62	QUANH QUAN	31	Nam	S
63	NGUYEN VAN XE	58	Nam	S
64	HO XUAN DUNG	57	Nam	S
65	DO DUC MOI	30	Nam	S
66	QUANH HOA	67	Nam	S
67	LE MINH NGOC	61	Nam	S
68	CU SAT	45	Nam	S

VII. HƯƠNG NGUYÊN COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	TRAN T. THUAN	40	Nữ	S
2	HOANG MINH BI	76	Nam	S
3	DUONG QUOC VINH	57	Nam	S
4	TRAN V. LUA	51	Nam	S
5	KAN NGA	31	Nữ	S
6	TAN V. TIENG		Nam	C

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

N	Name	Date of birth	Sex	Died - Alive
7	QUYNH HONG	51	Nam	S
8	KAN PHANG	31	Nữ	S
9	LE VAN TUAN	96	Nam	S
10	TRAN VAN CAO	61	Nam	S
11	HUYNH TAN VIEN	81	Nam	S
12	HO VAN XANH	75	Nam	S
13	HO XUAN PHI	73	Nam	S
14	NGUYEN THI XOA	86	Nữ	S
15	TRAN VAN GIANG	41	Nam	S
16	HO XUAN KHIET	72	Nam	S
17	PHAM V. BIA	57	Nam	S
18	NGUYEN VAN XAM	42	Nam	S
19	NGUYEN THANH SINH	45	Nam	S
20	LY HUNG	10	Nam	S
21	TRAN VAN GA	34	Nam	S
22	TRAN VIET NGHIA	70	Nam	S
23	HO VAN THAN	76	Nam	S
24	TRAN VIET MIT	80	Nam	S
25	LE VAN CHUA	87	Nam	S
26	NGUYEN VAN KIEU	87	Nam	S
27	HO VAN THOA	85	Nam	S
28	HO XUAN VIET	72	Nam	S
29	VUONG XUAN TRUNG	87	Nam	S
30	TA TAP	34	Nữ	C
31	NGUYEN VAN RAT	89	Nam	C
32	HUYNH TAN VUN	83	Nam	C
33	KAN CHUY	64	Nữ	C
34	TRAN BA LO	55	Nam	S
35	KAN LUM	41	Nữ	C
36	NGUYEN THANH	64	Nam	C
37	NGUYEN V. TU	81	Nam	C
38	TRAN V. SY	59	Nam	S
39	DANG V. MUNG	59	Nam	S
40	QUYNH RUNG	50	Nam	S
41	TON THI NHI	87	Nữ	S

VIII. HƯƠNG PHONG COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	NGUYEN DUY	78	Nam	S
2	NGUYEN DINH	66	Nam	S
3	HO DAC TAI	77	Nam	C
4	HOANG V. TY	83	Nam	C
5	LE DUY THANG	85	Nam	C

IX. HỒNG BẮC COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	TRAN VAN LONG	52	Nam	S
2	HO VAN TOI	60	Nam	S
3	QUYNH NGOT	36	Nam	S
4	QUYNH BUONG	27	Nam	S
5	NGUYEN XUAN MI	75	Nam	S
6	LE VAN LICH	71	Nam	S
7	QUYNH THANH	72	Nam	S
8	QUYNH DAM	60	Nam	S
9	QUYNH SAO	54	Nam	S
10	TRAN XUAN DIN	52	Nam	S
11	NGUYEN ANH TINH	48	Nam	S
12	TRAN VAN VINH	76	Nam	S
13	HOANG CHUA	61	Nam	S
14	LE KHAC DINH	60	Nam	S
15	HOANG VAN DOAN	51	Nam	S
16	LE V. NEM	52	Nam	S
17	LE MINH RAC	71	Nam	S
18	LE THI RUI	36	Nữ	S
19	HO VAN DU	77	Nam	S
20	LE THI CHAN	74	Nữ	S
21	KAN XUONG	61	Nữ	S
22	HOANG VAN CHUONG	47	Nam	S
23	TRAN V. PINH	42	Nam	S
24	LE MINH KHOA	64	Nam	S
25	LE THI KHEO	58	Nữ	S
26	HO VAN TOC	89	Nam	C
27	TR. V. THUONG	52	Nam	S

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

N	Name	Date of birth	Sex	Died - Alive
28	TRAN V. DUC	86	Nam	S
29	HO VAN SON	71	Nam	S
30	KAN HINH	21	Nữ	S
31	HO VAN GIANG	30	Nam	S
32	HO XUAN RAO	75	Nam	S
33	CU LIEU	69	Nam	S
34	KAN THUC	75	Nữ	S
35	QUYNH KHOI		Nam	S
36	KAN THOI	75	Nữ	S
37	QUYNH MIEC	29	Nam	S
38	THOT	43	Nam	C
39	HO THI LANH	65	Nữ	S
40	HO QUAN BEN	35	Nam	S
41	KAN LIEM	56	Nữ	S
42	HO VAN KIEM	83	Nam	S
43	LE VAN SAO	77	Nam	S
44	TRAN V. KHINH	61	Nam	S
45	LE VAN THANG	59	Nam	S

X. HỒNG HẠ COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	HO VAN XA	73	Nam	S
2	TON CHUNG	50	Nam	S
3	HO VAN HIEN	69	Nam	S
4	HO VAN HIEM	75	Nam	S
5	BO RO	62	Nam	S
6	PHAM HUYNH DOI	69	Nam	S
7	TRAN MINH XUONG	62	Nam	S
8	DANG VAN AN	60	Nam	S
9	CON THAM	62	Nam	S
10	HO VAN MOT	65	Nam	S
11	HO VAN THAN	75	Nam	S
12	KAN THAN	51	Nữ	S
13	HO THI BA	76	Nữ	S
14	AM VOL	51	Nam	C
15	HO VAN BAC	69	Nam	S
16	HO VAN EO	71	Nam	S
17	HOAI KAN	62	Nam	S
18	HO XUAN AT	59	Nam	S
19	HO NGOC DUONG	48	Nam	S
20	HO VAN AN	63	Nam	S
21	LE QUAY MAY	60	Nam	S
22	KON XAM	36	Nam	S
23	A MONG TE	59	Nam	S
24	HO VAN THOM	45	Nam	S
25	PIT HAY	61	Nam	S
26	HO XUAN ANH	68	Nam	S
27	HO VAN ANG	63	Nam	S
28	AMONG TOAN	85	Nam	S
29	HO VAN KHEO	60	Nam	C
30	KA DANG	68	Nam	C
31	HO VAN HUNG	72	Nam	S
32	CON HUNG	47	Nam	C
33	HO VAN TRAO	61	Nam	C
34	HO XUAN LU	61	Nam	S
35	MINH DUC LANG	59	Nam	S
36	AMONG TONH	50	Nam	S
37	KON KHOI	61	Nam	S
38	LE VAN HO	88	Nam	S
39	HO VAN XANG	73	Nam	S
40	HO VAN XO	71	Nam	S
41	DANG V. PHIN	80	Nam	S
42	CON HINH	45	Nam	S
43	HANH	71	Nam	S
44	KAN LOC	61	Nữ	S
45	XO	75	Nam	S
46	TRAN	73	Nam	S
47	KON CU	51	Nam	S
48	KON NUC	56	Nam	S

XI. HỒNG KIM COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	HO THANH THIET	93	Nam	C
2	HO VAN PHIM	95	Nam	C
3	HO VAN CHET	71	Nam	S
4	HO VAN THIEN	72	Nam	S
5	LE THANH NGUOI	87	Nam	C
6	QUYNH NGHIA	64	Nam	C
7	HO VAN CHUONG	76	Nam	S

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

N	Name	Date of birth	Sex	Died - Alive
8	HO VAN BINH	80	Nam	C
9	QUYNH VAI	70	Nam	S
10	KAN TRAO	71	Nữ	C
11	QUYNH BINH	51	Nam	C
12	QUYNH NGUN	59	Nam	C
13	PA KO HUNG	51	Nam	C
14	HA VAN DONG	61	Nam	C
15	HO VAN THUAN	41	Nam	S
16	CU TUOL	40	Nam	S
17	NGUYEN VAN THAN	85	Nam	S
18	HOANG MINH TAN	22	Nam	S
19	QUYNH UM	21	Nam	S
20	QUYNH GIAP	56	Nam	S
21	HO VAN XEP	42	Nam	S
22	LE THANH NGO	24	Nam	C
23	QUYNH LY	51	Nam	S
24	HO VAN DONG	85	Nam	C
25	LE VAN HAO	87	Nam	C

XII. HỒNG HẠ COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	KAN LOI	30	Nữ	S
2	HO VAN ROI	50	Nam	S
3	NGUYEN XUAN LOAI	75	Nam	C
4	LE THI LANG	68	Nữ	S
5	HO VAN THANH	79	Nam	C
6	QUYNH VUON	56	Nam	S
7	KAN KHE	56	Nữ	C
8	HO DUC NUI	47	Nam	S
9	CU DUNG	67	Nam	C
10	LE THI THANG	71	Nữ	S
11	NGUYEN VAN NGOM	76	Nam	S
12	NGUYEN HUY LAI	47	Nam	S
13	NGUYEN H. HA	43	Nam	S
14	VO HONG		Nam	C
15	QUYNH AN	65	Nam	C
16	HO VAN HUY	62	Nam	S
17	HOANG V.DIEP	57	Nam	S
18	NGUYEN HAI TEO	83	Nam	S
19	KAN TRUT	20	Nữ	S
20	QUYNH CHIEN	57	Nam	C
21	NGUYEN THI CHON	75	Nữ	S
22	KAN TIEM	49	Nữ	S
23	QUYNH HONG	38	Nam	S
24	NGUYEN V. UY	45	Nam	S
25	LE VAN LOI	89	Nam	C
26	KANH HE	45	Nam	C
27	HO VAN OI	61	Nam	C
28	HO VAN TIEM	62	Nam	S
29	HO THANH BINH	61	Nam	S
30	HO TRONG CHUNG	64	Nam	S
31	NGUYEN HAI SON	55	Nam	S
32	HOANG RUNG	62	Nam	S
33	QUYNH MO	33	Nam	S
34	HOANG THI NHIEN	83	Nữ	S
35	HOANG TINH	83	Nam	S
36	LE MINH CHAI	69	Nam	S
37	KAN VUT	45	Nam	S
38	KAN HOA	37	Nam	S
39	LE THI HƯƠNG	57	Nữ	S
40	LE THANH LAN	47	Nam	S
41	KAN NHAT	52	Nữ	S
42	QUYNH HOA	37	Nam	S

XIII. HỒNG THÁI COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	HO THI DON	85	Nữ	S
2	QUYNH LAM	40	Nam	S
3	LE VAN LOAN	70	Nam	S
4	HO THI HUONG	33	Nữ	S
5	HO VAN LOC	60	Nam	S
6	HO VAN MIET	58	Nam	S
7	KAN LAP	45	Nữ	S

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

N	Name	Date of birth	Sex	Died - Alive
8	CU THOA	34	Nam	S
9	HO VAN XANH	39	Nam	S
10	TO THI NHA	75	Nữ	S
11	HO V. KHANH	70	Nam	S
12	CU THUONG	48	Nam	C
13	HO VAN SONG	54	Nam	S
14	VO KHA	21	Nam	S
15	HO VAN DA	27	Nam	S
16	QUYNH NGANH	60	Nam	C
17	HO VAN BAM	55	Nam	S
18	CU LU	70	Nam	C
19	QUYNH NGAO	23	Nam	S
20	KAN HE	61	Nữ	S
21	HO THANH TOP	32	Nam	S
22	A VIET SON	51	Nam	S
23	HO VAN LICH	40	Nam	S
24	KAN RUI	61	Nam	S
25	HO DAC THO	64	Nam	S
26	NGUYEN VAN VUON	76	Nam	C
27	QUYNH VINH	36	Nam	S
28	KON CUL	59	Nam	C
29	HO VAN KINH	59	Nam	S
30	HO VAN MOT	31	Nam	S
31	HO VAN NHOM	40	Nam	S
32	HO VAN BUOI	36	Nam	S
33	KON KHIA	47	Nam	C
34	HO VAN KHA	53	Nam	S
35	CU CUT	68	Nam	C
36	HO VIET VA	83	Nam	C
37	A KHOU	84	Nam	C
38	HO VAN DOAN	74	Nam	C
39	BLOM	59	Nam	C
40	HO VAN NGHIENG	83	Nam	C
41	HO VAN BAC	89	Nam	S
42	HO VAN VA	77	Nam	S
43	HO VAN TOAN	34	Nam	S
44	HO VAN HANG	62	Nam	S
45	HO VAN MINH	73	Nam	S
46	QUANG TROI	42	Nam	S
47	VO PHA	27	Nam	S
48	QUANH DIA	41	Nam	S
49	HO VAN VON	50	Nam	S
50	HO V. HIEU	32	Nam	S
51	HO THI CHAM	62	Nữ	S
52	LO THI KIENG	56	Nữ	S
53	HO VAN KHO	96	Nam	S
54	HO VAN MUT	46	Nam	S
55	NGUYEN V.HUY	61	Nam	S
56	NGUEN VAN PHUNG	63	Nam	S
57	HO VAN NHAT	41	Nam	S
58	LE HOANG NGAN	65	Nam	S
59	LE VAN MICH	49	Nam	S
60	HO VAN HOAT	89	Nam	S
61	HO VAN IN	58	Nam	S
62	HO VAN BUOI	83	Nam	S

XIV. HỒNG THƯỢNG COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	NGUYEN XUAN MIET		Nam	C
2	NGUYEN THANH DON		Nam	C
3	VAN CHUONG		Nam	C
4	HO THI KHIET		Nữ	C
5	CU LE		Nam	C
6	HA NAM		Nữ	C
7	VO NAM		Nam	C
8	HO THI MANG		Nữ	C
9	VO TRAN		Nam	S
10	CAN CHUC		Nữ	C
11	KAN THAO		Nữ	S
12	NGUYEN VAN CHUC		Nam	S
13	HO VAN LIENG		Nam	C
14	LE VAN CHO		Nam	S
15	CAN NGAN		Nữ	S
16	HO VAN MUA		Nam	S
17	LE V. MIENG		Nam	S
18	KON DUA		Nam	S
19	PHAM T. HONG		Nữ	S
20	NGUYEN XUAN MO		Nam	C
21	HO VAN MOI		Nam	S
22	KIM DEP		Nữ	S

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

N	Name	Date of birth	Sex	Died - Alive
23	LE THI NGO		Nữ	S
24	KON DUC		Nam	S
25	LE HONG VO		Nam	S
26	CON LY		Nữ	S
27	HO THI XOA		Nữ	S
28	HO VAN CHINH		Nam	S
29	KAN TIN		Nữ	S
30	HO XUAN HIEU		Nam	S
31	HO V. PHUONG		Nam	S
32	HO VAN HUNG		Nam	S
33	PHAN THANH DINH		Nam	S
34	KON NAN		Nam	S
35	NGUYEN XUAN NGOI		Nam	S
36	KAN MOI		Nam	S
37	CON MENH		Nam	S
38	PHAM NGOC MOAN		Nam	C
39	HO THI MANH		Nữ	C
40	HO VAN KE		Nam	C
41	HO VAN CANG		Nam	C
42	KAN CANG		Nữ	C
43	HO VAN CUON		Nam	C
44	LE THI HOANG		Nữ	S
45	VO NGHINH		Nam	S
46	CAN DIN		Nữ	S
47	LE VAN LONG		Nam	S
48	HO MANH NGHIN		Nam	S
49	KON BUI	36	Nam	S
50	CU BAO	50	Nam	S
51	HO VAN DOAN	60	Nam	S
52	LE THUONG THIEN	50	Nam	S
53	HO VAN CUONG	47	Nam	S
54	HO VAN CUONG	47	Nam	S
55	LE VAN THUN	66	Nam	S
56	LE THI CUC	66	Nữ	S
57	KAN LUY	62	Nữ	S
58	HO V. PHUONG	71	Nam	S
59	KON DUONG	46	Nam	S
60	CAU DIR	61	Nam	S
61	KAN NAO	61	Nữ	S
62	CAN NGOC	51	Nữ	S
63	NGUYEN VAN CU	64	Nam	S
64	LE THI THIET	46	Nữ	S
65	CAN THUM	36	Nữ	S
66	LE THANH NAM	37	Nam	S
67	NGUYEN VAN U	58	Nam	S
68	CAN DAI	59	Nữ	S
69	NGUYEN VAN HUNG	76	Nam	S
70	HO VAN THOI	40	Nam	S
71	KON NGHIEP	63	Nam	S
72	KON LUN	59	Nam	S
73	HO VAN THANH	59	Nam	S

XV. HỒNG THUỶ COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	HO VAN MOAI	76	Nam	S
2	KAO LAM	76	Nữ	S
3	KAN KHANG	60	Nữ	S
4	HO VAN MAN	71	Nam	S
5	QUYNH NGAM	67	Nam	C
6	HO VAN ET	65	Nam	S
7	LE VAN HUONG	60	Nam	S
8	QUYNH HOA MY	60	Nam	S
9	HO VAN THANG	90	Nam	S
10	QUYNH BAY	73	Nam	S
11	TA DUC VAN	40	Nam	S
12	HO VAN TANH	82	Nam	S
13	LE THI KHOI	64	Nữ	S
14	LE THI KHIEN	76	Nam	S
15	QUYNH BI	76	Nam	S
16	HO A CHAN	87	Nam	C
17	QUYNH DANG	72	Nam	S
18	CU DAO	76	Nam	S
19	HO VAN SANG	82	Nam	C
20	KHEP	85	Nữ	C

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

XVI. HỒNG TRUNG COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	HO V. THACH	82	Nam	S
2	KAN VIONG	51	Nữ	S
3	HO VAN AN	73	Nam	S
4	HO VAN TRANG	46	Nam	C
5	LE VAN CHUONG	66	Nam	S
6	HO VAN A	75	Nam	S
7	HO VAN LIEU	81	Nam	C
8	TRAN VAN NOAN	85	Nam	S
9	TRAN XUAN VINH	74	Nam	S
10	HO VAN KHAI	41	Nam	S
11	HO QUANG TIEN	41	Nam	C
12	HO VAN TAM	80	Nam	S
13	HO V. NGHIEM	77	Nam	S
14	KAN TOAN	54	Nữ	S
15	HO VAN THIEN	60	Nam	S
16	A O	88	Nam	S
17	HO VAN GIO	89	Nam	S
18	HO VAN LINH	54	Nam	S
19	QUYNH TY LA	73	Nam	S
20	HO XUAN IN	79	Nam	S
21	NGOC THANH TAT	50	Nam	S
22	KAN SEN	56	Nữ	S
23	HO VAN HUT	45	Nam	S
24	TRAN DUY DUC	60	Nam	S
25	A TAO	43	Nam	C
26	KA NGUON	32	Nữ	S
27	QUYNH HOA	31	Nam	S
28	QUYNH TU	31	Nam	S
29	LE THI HONG	59	Nữ	S
30	CU LAN	49	Nam	S
31	KAN A RUM	46	Nữ	S
32	QUYNH NHO	67	Nam	S
33	TRAN XUAN OAI	77	Nam	S
34	KAN HIEM	57	Nữ	S
35	HO T. KHUONG	71	Nữ	S
36	KAN CHO HA	71	Nữ	C
37	KAN LIEM	51	Nữ	S
38	QUYNH LY	70	Nam	S
39	QUYNH VINH	41	Nam	S
40	HO XUAN BOT	87	Nam	C
41	VO MIA	49	Nam	C
42	QUYNH LEP	38	Nam	C
43	CON VE	61	Nam	C
44	VO DIA	41	Nam	C
45	HO VAN THUC	91	Nam	C
46	TRAN VAN HUA	77	Nam	S
47	HO XUAN DO	79	Nam	S
48	QUYNH NHUNG	40	Nam	S
49	LE VAN KHET	68	Nam	S
50	HO VAN TAO	74	Nam	S
51	LE DINH NGANG	82	Nam	S
52	HO THI LAI	74	Nữ	S
53	TRAN THI NGOT	79	Nữ	S
54	HO VAN CU	44	Nam	S
55	HO XUAN LE	54	Nam	S
56	CU XUA	45	Nam	S
57	HO VAN LANG	58	Nam	S
58	HO VAN VAN	82	Nam	S
59	HO VAN TUAN	51	Nam	S
60	CU VIN	34	Nam	S
61	TRAN VAN XING	48	Nam	S
62	HO VAN PHONG	78	Nam	S
63	KON BIEN	35	Nam	S
64	KON XEN	59	Nam	S
65	PHAM THAI DUONG	95	Nam	S
66	QUYNH AN	49	Nam	C
67	HO VAN HANG	56	Nam	S
68	PHAM THAI LAP	65	Nam	C
69	HO VAN HICH	81	Nam	C
70	TRAN VAN TEL	64	Nam	C
71	HO VAN CU CHONG	71	Nam	C
72	QUYNH KHET	41	Nam	C
73	HO VAN CU TIN	87	Nam	C
74	HO VAN YEU	79	Nam	C
75	HO VAN LANH	73	Nam	C
76	HO VAN THUON	83	Nam	C
77	HO VAN NOI	72	Nam	C
78	KAN PAP	83	Nam	C
79	HO VAN NIEU	94	Nam	C
80	KAN XOA	73	Nữ	S
81	LE VAN LOAI	85	Nam	C
82	HO THI HON	95	Nữ	C

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

N	Name	Date of birth	Sex	Died - Alive
83	HO MANH THA	85	Nam	C
84	QUYNH NGHIA	36	Nam	C
85	HO XUAN SANG	89	Nam	C
86	HIEP	89	Nam	C
87	QUYNH DEN	38	Nam	S
88	HO MINH THUOI	41	Nam	S
89	TRAN VAN HAM	85	Nam	S
90	HO VAN LOI	73	Nam	S
91	KAN DUC	65	Nữ	S
92	VO HINH	30	Nam	S
93	KAN NHUNG	54	Nữ	S
94	HO XUAN LIA	63	Nam	S
95	QUYNH DO	46	Nam	S
96	TRAN XUAN DUA	69	Nam	S
97	HO VAN LIN	65	Nam	S

XVII. HỒNG VÂN COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	HO VAN VO	92	Nam	C
2	KONH SAN	47	Nữ	S
3	HO VAN BUOU	85	Nam	C
4	LE VAN GIAN	77	Nam	S
5	LE THANH TU	73	Nam	S
6	HO VAN LA	77	Nam	S
7	KAN HUONG	41	Nữ	S
8	HO VAN KINH	83	Nam	C
9	LE VAN HUYNH	77	Nam	S
10	HO VAN TAN	60	Nam	S
11	LE VAN HA	72	Nam	S
12	KA CHI	29	Nữ	S
13	CON DIN		Nam	C
14	TRAN XUAN TAY	72	Nam	S
15	HO VAN DAO	86	Nam	S
16	LE MANH THAM	76	Nam	C
17	TRAN XUAN TU	70	Nam	S
18	LE MINH XUAN	59	Nam	S
19	NG. HONG LE	54	Nam	S
20	LE TRAO CO	86	Nam	C
21	LE THANH BAY	50	Nam	C
22	HO DAI PHU	55	Nam	S
23	TRAN XUAN NHAU	73	Nam	S
24	PHAM VAN HAI	65	Nam	S
25	LE VAN THOM	93	Nam	C
26	LE VAN NGA	63	Nam	S
27	HO VAN HUNG	78	Nam	S
28	TRAN XUAN PHAN	47	Nam	S
29	TRAN XUAN THANH	92	Nam	S
30	PHAM TIEN LUC	41	Nam	S
31	HO QUANG DONG	65	Nam	S
32	TRAN XUAN NHAT	83	Nam	C
33	HO VAN VU	86	Nam	S
34	HO VAN NUNG		Nam	C
35	HO THI VANG	73	Nam	S
36	HO VAN KAN	95	Nam	C
37	HO VAN KEP	93	Nam	S
38	LE VAN TEL	89	Nam	C
39	LE VAN LIEU	97	Nam	C
40	HO VAN TRUNG	95	Nam	C
41	QUYNH ON	31	Nam	S
42	HO VAN TIEP	75	Nam	C
43	HO XUAN LAI	71	Nam	C
44	VO LANG	21	Nam	C
45	NGUYEN VAN BIEN	73	Nam	S
46	QUYNH MINH	74	Nam	S
47	QUYNH THUONG	79	Nam	S
48	VO TAI	31	Nam	S
49	HO KHIER	96	Nam	C
50	KAN XE	61	Nữ	S
51	SAL	94	Nữ	S
52	NGUON	91	Nam	C
53	QUYNH THIA	58	Nam	S
54	KAN SON	51	Nữ	C
55	KAN KINH	51	Nữ	C
56	TRAN VAN PHEN	80	Nam	S
57	HO THI TUOI	58	Nữ	S
58	QUYNH XUA	31	Nam	S
59	HO THI NGOI	78	Nữ	S

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

N	Name	Date of birth	Sex	Died - Alive
60	QUYNH MOT	26	Nam	C
61	QUYNH NGOC	56	Nam	S
62	LE VAN NGANH	89	Nam	C
63	QUYNH THI	53	Nam	C
64	HO DAI PHU	55	Nam	S
65	QUYNH SAN	48	Nam	S
66	KAN TANG	52	Nữ	S
67	QUYNH NGHEN	38	Nam	S
68	KAN DIN	50	Nữ	S
69	HO VAN REL	83	Nam	S
70	CU XEL	47	Nam	S
71	LE VAN DAN	77	Nam	S
72	LE VAN CHUONG	76	Nam	S
73	NG. VAN LIEN	59	Nam	S
74	QUYNH NGA	37	Nam	S
75	HO VAN VIET	89	Nam	S
76	KAN LOT	50	Nữ	S
77	TRAN NGOC DIN	57	Nam	S
78	LE VAN PHONG	74	Nam	S
79	QUYNH MONG	76	Nam	S
80	NGUYEN VAN NGHI	77	Nam	S
81	HO THI VAN	92	Nữ	S
82	QUYNH XANG	25	Nam	S
83	LE VAN RO	77	Nam	S
84	HO THUONG LOM	39	Nam	S
85	HO VAN DAT	81	Nam	S
86	HO VAN LAM	75	Nam	S
87	HO VAN HUNG	82	Nam	S
88	QUYNH THI	59	Nam	S
89	QUYNH THU	61	Nam	S
90	QUYNH THONG	32	Nam	S
91	HO VAN PHUC	79	Nam	S
92	NGUYEN VAN HIENG	80	Nam	C
93	HO VEN TE	93	Nam	C
94	TRAN XUAN BI	93	Nam	C
95	LE VAN NGOI	90	Nam	C

XVIII. PHÚ VINH COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	KAN HE	59	Nam	S
2	HO VIET TIEN	61	Nam	S
3	VO THI YEM	40	Nữ	S
4	HO VAN HIEN	43	Nam	S
5	HO VAN HUAN	53	Nam	S
6	PHAN V. THANH	75	Nam	C
7	PHAN MAN	50	Nam	S
8	HO THI THANH	73	Nữ	S
9	PHAM DINH DOC	93	Nam	C
10	PHAM V.KHINH	59	Nam	C
11	LE HONG VUONG	88	Nam	C
12	LE THI CHIEM	84	Nữ	C
13	PHAM VAN NGA	69	Nam	C
14	HO DAC HOA	69	Nam	S
15	PHAM DINH DIN	88	Nam	S
16	PHAM TH. HA	66	Nữ	S
17	HO RO	40	Nam	C
18	VAN THUONG	52	Nam	C
19	HO VAN HUE	58	Nam	S
20	DINH HIEN	72	Nam	S
21	HO V. MINH	62	Nam	S
22	NGUYEN HUONG	65	Nam	S
23	VO HUU DUC	73	Nam	S
24	HO THI LIEN	58	Nữ	S
25	HO VAN LONG	81	Nam	C
26	HO VAN HAO	66	Nam	C
27	PHAN LE	73	Nam	C
28	NGUYEN NGOC THANH	88	Nam	C
29	TRAN HUU TAI	85	Nam	C
30	HO THI MINH	76	Nữ	C
31	HO THI GAI	67	Nữ	C

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

XIX. SƠN THUỶ COMMUNE

N	Name	Date of birth	Sex	Died - Alive
1	HA TRI	68	Nam	C
2	HO XUONG	40	Nam	S
3	NGUYEN THU THANH	81	Nữ	S
4	LE CANH CUONG	70	Nam	S
5	DAO QUANG LOI	59	Nam	S
6	DOAN VAN DUC	60	Nam	S
7	LE CONG KHANH	84	Nam	C
8	VAN BAY	71	Nam	C
9	VAN LUC	65	Nam	C
10	TRAN VAN LOC	88	Nam	C
11	PHAM THI LAI	62	Nữ	C
12	PHAN VAN BINH	75	Nam	C
13	NGUYEN DINH TRUNG	63	Nam	C
14	DOAN VAN THANH	78	Nam	C
15	TRAN NHA TRANG	66	Nam	S
16	PHAN MINH	70	Nam	S
17	DOAN VAN TOAN	80	Nam	S
18	PHAN XUAN	58	Nam	S
19	PHAN NGUNG	53	Nam	S
20	TRINH VAN MINH	65	Nam	S
21	PHAN LOC	60	Nam	S
22	NGUYEN TANH	68	Nam	S
23	HOANG ANH	66	Nam	S
24	NGUYEN THOI	41	Nam	S
25	VAN XUAN PHO	61	Nam	C
26	TRAN VAN TRACH	83	Nam	C
27	NGUYEN THAT	90	Nam	C
28	TRAN VAN HUONG	94	Nam	S

XX. A LƯỚI TOWN

N	Name	Date of birth	Sex	Died - Alive
1	LE THI DAU	56	Nữ	S
2	KAN TREN	31	Nữ	S
3	HO CHIEN	85	Nam	C
4	LE VAN PRANG	74	Nam	S
5	LE THI PROT	98	Nữ	C
6	LE VAN PI	65	Nam	S
7	HO VIET KHOI	56	Nam	S
8	PHAN CU	57	Nam	S
9	HO PHONG	41	Nam	S
10	HO VAN UI	88	Nam	C
11	KAN POONG	46	Nữ	S
12	KAN BINH	46	Nữ	S
13	HO THI PHICH	96	Nữ	C
14	HO THI PHEN	94	Nữ	C
15	HO VAN HONG	91	Nam	C
16	LE XUAN PHIN	78	Nam	S
17	LE XUAN THEO	93	Nam	C
18	LE XUAN THAN	10	Nam	C
19	LE XUAN THANG	97	Nam	C
20	LE AI TUAN	32	Nam	S
21	HO THI PHENH	93	Nữ	S
22	HO THI TINH	60	Nữ	S
23	HOANH VAY	74	Nam	S
24	HOANG THI CHUC	46	Nữ	C
25	TRUONG MINH DUNG	69	Nam	S
26	NGUYEN NGOC DUNG	65	Nam	S
27	TRAN MINH TINH	71	Nam	S
28	HO VAN BA	76	Nam	C
29	HO TRUNG	53	Nam	S
30	HO VAN TOI	76	Nam	S
31	LE AI MUNG	79	Nam	C
32	LE AI KHANH	72	Nam	C
33	BUI VAN SANG	53	Nam	S
34	NG.NGOC HIEN	73	Nam	S
35	A MONG GHE	52	Nam	S
36	HO VAN QUY	81	Nam	S
37	HO VAN MIR	47	Nam	S
38	HO X. THUONG	86	Nam	S
39	HO TH. HOA HONG	74	Nữ	S

ANNEX III

SUMMARY RESULTS OF THE SURVEY OF EVERY COMMUNE IN A LUOI VALLEY

N	Name	Date of birth	Sex	Died - Alive
40	LE XUAN MAY	73	Nam	S
41	CU RA	47	Nam	S
42	LE THI PHUONG	54	Nữ	S
43	CON PRON	24	Nam	S
44	KAN PRA	47	Nữ	S
45	CU TRUONG	68	Nam	C
46	TRAN VAN THANH	60	Nam	S
47	HO VAN OAY	82	Nam	C
48	HO VAN TIM	81	Nam	C
49	LE XUAN LAM	60	Nam	S
50	HO DINH PHON	63	Nam	S
51	NGUYEN VAN BINH	72	Nam	S
52	KON XAN	44	Nam	S
53	TRAN BA SU	55	Nam	S
54	NGUYEN VAN GIAO	45	Nam	S
55	KAN YUAR	29	Nữ	S
56	HO VAN TONG	80	Nam	S
57	TRAN HAI DUONG	79	Nam	S
58	HUYNH BAT	37	Nam	C
59	NGO THI LANH	77	Nữ	S
60	HO VAN ANH	82	Nam	C
61	NGUYEN NGOC NHAN	82	Nam	C
62	HO THI BOI	99	Nữ	C
63	HO VAN MIA	63	Nam	C
64	VAN CHUONG	52	Nam	C
65	PHAN VAN THANH	80	Nam	C
66	PHAN PHUOC	91	Nam	C
67	PHAN THI TE	82	Nữ	C
68	HO VAN SON	88	Nam	S
69	NGUYEN THI THUY HA	83	Nữ	S
70	HO VAN THANG	43	Nam	S
71	KAN HIEU	50	Nữ	S
72	CU DE	37	Nam	S
73	LE DUC THANG	62	Nam	S
74	VAN DUC TRUNG	90	Nam	C
75	PHAN NGOC PHUOC	91	Nam	C
76	HO VAN DAN	85	Nam	C
77	HO VAN VE	76	Nam	S
78	KAN AO	65	Nữ	C
79	QUYNH VUA	46	Nam	C
80	CU BIN	47	Nam	C
81	QUYNH CU NO	44	Nam	C
82	HO VAN AO	88	Nam	C
83	QUYNH AO	61	Nam	C
84	LE VAN TAN	72	Nam	C
85	HO XUAN LIM	47	Nam	S
86	HO VAN XUA	70	Nam	C
87	LE QUANG VINH		Nam	C
88	LE THI HUE	62	Nữ	S
89	LE AI TUAN	32	Nam	S
90	HO HAI HOAI	78	Nam	S
91	HO XUAN THAO	79	Nam	S
92	HO VAN HOI	85	Nam	S
93	NGUYEN XUAN HINH	80	Nam	S

ANNEX IV
SOME PICTURES OF AWARENESS EDUCATION PROGRAM DONE IN A LUOI IN AUGUST, 2001

I. BÀI SƠ CỨU VẾT THƯƠNG BOM MÌN - THE LESSON OF FIRST AIDS FOR UXO'S INJURIES .

Bài này được phát cho các cán bộ y tế từ cấp tuyến Huyện đến Xã ở A Lưới.

- This lesson is updated for medical techniciants of District Hospital and all clinics of A Luoi valley

Điều trị cấp cứu kỳ đầu vết thương mìn
- Beginning treatment for UXO's injuries.

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Chủ nhiệm khoa Phẫu Thuật Chấn Thương Chỉnh Hình Quân Y Viện 108.
- Dr. Nguyen Tien Binh
Director of Trauma Surgical Department
Of Army Hospital 108.

1. Mở đầu - Introduction

Cho đến nay, mặc dù chiến tranh đã qua đi nhưng vết thương do mìn và hậu quả của nó vẫn còn tồn tại và tiếp tục có nguy cơ gây thương vong. Vết thương do mìn luôn là một vấn đề khó đặt ra và đòi hỏi phải có đường hướng giải quyết tốt để giảm tới mức tối đa tỷ lệ tàn phế, tử vong cho con người. Đối với các tuyến cấp cứu kỳ đầu, những hiểu biết cơ bản về sốc chấn thương, đặc điểm vết thương do mìn và những nguyên tắc cơ bản trong cấp cứu kỳ đầu mang một ý nghĩa quan trọng đặc biệt. Trong khuôn khổ có hạn của một bài viết, chúng tôi cố gắng trình bầy những khái niệm căn bản và những nguyên tắc trong sử trí kỳ đầu đối với vết thương do mìn.

Ngày nay, trong quá trình khôi phục hậu quả chiến tranh, xây dựng đất nước, những thương tích do mìn gây ra cũng vẫn gặp thường xuyên ở những vùng chiến sự trước đây. Đối với các cán bộ y tế ở tuyến đầu rất cần có những kiến thức tổng quan, những nguyên tắc xử trí kỳ đầu cơ bản để có thể giảm bớt tới mức tối đa những di chứng do vết thương mìn gây ra. Bài viết này nhằm cung cấp một số hiểu biết và nguyên tắc cơ bản trong cấp cứu kỳ đầu đối với vêts thương do mìn gây ra.

Đặc điểm cơ bản của những vết thương do mìn là ngoài sức công phá của mảnh kim loại với vận tốc lớn còn do sóng nổ. Chính sự công phá của sóng nổ mới gây những thương tổn vi thể đối với tế bào và tổ chức làm cho diến biến bệnh lý của vết thương mìn bao giờ cũng nặng nề và phức tạp hơn.

2- Những nguyên tắc cơ bản điều trị sốc chấn thương do mìn – Base principles of treatment for trauma-shock caused by UXO's explosion.

Sốc chấn thương là một trong những biến chứng cấp nặng của các vết thương chiến tranh và là một nguyên nhân chính gây tử vong. Những vết thương do mìn cũng thường gây sốc đối với bệnh nhân. Tỷ lệ chung của sốc

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chân thương ở tuyến đầu là 11,18%. Tỷ lệ sốc do vết thương chiến tranh theo vị trí cơ thể có khác nhau. Theo tổng kết kinh nghiệm điều trị vết thương chiến tranh của ngành quân y năm 1989 thì tỷ lệ sốc gặp ở vết thương đầu mặt cổ chiếm 9,92%, ngực lưng 14,54%, vùng bụng chậu 12,10%, chi trên 5,4%, chi dưới 10,2%, nhiều vị trí trên cơ thể 13%. Các số liệu trên cho thấy ở những vùng có các bộ phận quan trọng, phân bố nhiều mạch máu thần kinh thì tỷ lệ sốc cao. Các vết thương thấu bụng, thấu ngực, sọ não, dập nát chi, bỏng rộng và vết thương phối hợp thường hay gây sốc. Nguyên nhân gây nên tình trạng sốc là do bệnh nhân bị mất máu nhiều tử các vết thương, đau và hoảng loạn về tinh thần

Đối với tuyến trước, việc chẩn đoán sốc phải dựa vào:

- Thăm khám đánh giá tính chất, mức độ thương tổn,
- Tình trạng toàn thân (tỉnh táo tiếp xúc tốt hay đờ đẫn...), mạch, nhiệt độ, huyết áp, nhịp thở, màu sắc da và niêm mạc.
- Các vết thương và tính chất của thương tổn của từng vết thương.
- Thời gian bị thương (là yếu tố có giá trị để tiên lượng và sử trí)

Sốc chấn thương diễn biến theo 2 thời kỳ: Thời kỳ sốc tiềm tàng, sốc cương khi cơ thể bệnh nhân còn có khả năng chịu đựng với tình trạng đau và mất máu. Thông thường chỉ số huyết áp động mạch vẫn bình thường nhưng tần số mạch đã bắt đầu tăng cao trên 110 lần/phút.

Thời kỳ sốc nhược với ba mức độ khác nhau:

- Mức độ 1 (sốc nhược nhẹ): Thương tổn ở mức độ vừa, mất máu < 1000 ml. Bệnh nhân tỉnh đáp ứng được nhưng bắt đầu chậm. Có thể có cơn rét run, khát nước. Da và niêm mạc hơi xanh, nhiệt độ hạ 36-36độ5. Huyết áp động mạch từ 90-100mmHg, mạch nhanh 100-120lần/phút.
- Mức độ 2 (sốc nhược vừa): Tình trạng mất máu nhiều hơn từ 1000-1500ml. Bệnh nhân còn tỉnh nhưng đáp ứng chậm, lơ mơ. Giảm cảm giác phản xạ, da và niêm mạc xanh nhợt, lạnh. Huyết áp động mạch giảm 60-90mmHg, mạch nhanh trên 120lần/phút.
- Mức độ 3 (sốc nhược nặng và rất nặng): Bệnh nhân lơ mơ, gọi hỏi không đáp ứng, da và niêm mạc xanh nhợt nhạt có thể có những vết tím. Thở nhanh nông 30-40 lần/phút. Mạch nhanh nhỏ khó bắt, huyết áp tụt có thể xuống dưới 60mmHg. thiểu niệu hay vô niệu

Để điệu trị dự phòng đối với sốc chấn thương ở tuyến đầu cần làm tốt các kỹ thuật sau đây:

- Giảm đau an thần là việc làm đầu tiên. Trước khi tiến hành các công việc khác như băng bó, cố định, vận chuyển bệnh nhân về tuyến sau thì giảm đau là việc phải làm đầu tiên rất quan trọng. Không nên vội vàng bê, vác nạn nhân ra xa khi chưa được giảm đau tốt. Kinh nghiệm cho thấy chính xử trí ban đầu không đúng sẽ góp phần làm cho tình trạng của bệnh nhân nặng lên và đôi khi chính người đến cấp cứu đã làm cho tình trạng nạn nhân nặng lên vì những can thiệp không đúng nguyên tắc. Nếu nạn nhân bị đất cát vùi một phần hoặc toàn bộ chi thể, cơ thể thì phải nhành chóng bới phần chi thể bị vùi lấp ra khỏi đất cát và để nguyên tại cạnh noi tai nạn.

Tốt nhất là cho dùng một ống Morphin 0,01, Promedol 0,02 tiêm bắp thịt. 1 ống trợ tim như Caphein 0,25, hay 1 ống Spartein 0,25. Nếu có điều

kiện thì phóng bế Novocain 0,25% vào gốc chi tuỳ theo vị trí. Cánh tay có thể từ 30-40ml, đùi từ 50-70ml.

- Tiến hành băng cầm máu vết thương, nếu có chảy máu lớn thành tia thì phải đặt Garo ở gốc chi bằn dây cao su to bản hay bằng vòng dây vải, dây thừng nhỏ với một thanh gỗ để xoắn vòng dây cho chặt tới khi máu ngừng chảy. Đối với những trường hợp đặt Garo thì trên đường vận chuyển nạn nhân về tuyến sau phải chú ý mấy nguyên tắc như làm phiếu ghi chép thời gian đặt Garo, cứ 30 phút lại nới một lần cho máu chảy ứa ra ở vết thương thì lại thắt trở lại. Ghi chép việc bàn giao khi có sự thay đổi người theo dõi và giữa các tuyến vận chuyển. Cũng nên chú ý rằng chỉ những trường hợp vạn bất đắc dĩ, các động mạch chính chảy máu ồ ạt mới nên dùng tới biện pháp đặt Garo để cầm máu.

- Phải bất động ngay chi thể bị thương tổn bằng nẹp gỗ, nẹp tre hoặc những vật liệu sẵn có như đòn gánh, gậy... Về nguyên tắc, không nên kéo nắn chi thể về trạng thái như chi bên lành mà nên bất động nguyên trạng. Bất động tạm thời là để giảm đau khi vận chuyển, để tránh di lệch thứ phát hoặc gây thương tổn thứ phát đối với thần kinh mạch máu. Đôi khi vì thiếu kinh nghiệm, người cấp cứu kỳ đầu đã kéo nắn những biến dạng quá lớn của chi thể làm cho người bệnh đau quá gây choáng và làm thương tổn thứ phát thậm trí gây biến chứng nguy hại cho nạn nhân.

- Tổ chức vận chuyển nạn nhân về tuyến sau càng sớm càng tốt. Khi vận chuyển phải để nạn nhân nằm trên ván cứng, đầu thấp, ngửa và nghiêng sang bên đề phòng nạn nhân nôn sặc vào đường thở. Trên đường vận chuyển, nên cho nạn nhân thường xuyên uống nước đường có pha lẫn chút muối.

3- Nguyên tắc sử trí một số vết thương do mìn – Principles of treatment for UXO's injuries .

a- Đối với vết thương phần mềm – For soft tissue's injuries

Hiệu lực sát thương của mìn do tác dụng trực tiếp của sản phẩm gây nổ (khối lượng khí hình thành nhiệt độ cao phát sinh ra một công cơ học làm vỡ rạn, phá nát phần cơ thể), do tác động của sóng nổ (xung lượng của sóng xung kích dẫn truyền trong không khí, trong nước hoặc qua chất rắn), tác dụng của mảnh phá kim loại. Những loại mìn nổ còn gây sát thương bằng các mảnh nhỏ có vận tốc lớn cộng với mật độ dầy đặc.

Các loại mảnh nhỏ thả từ máy bay như mìn túi vải XM12, mìn cánh dơi XM41E1 thường gây các vết thương phần mềm nhỏ kèm theo sưng nề ở chi thể da có những đám bầm tím... Các loại mìn M14, K58, gây loại vết thương lớn hơn, có thể gây dập nát, bong lóc lớn. Các laọi mìn sát thương bằng cả sức nổ và mảnh phá như mìn định hướng Clâymo M18A1, mìn vướng nổ CBU-34A,42B, mìn chân voi M16, A1, A2, mìn lựu đạn P4 78Z2, mìn muỗi KP2, POMZ2, mìn nhẩy M2A... Các laọi mìn này gây sát thương nặng bằng sóng nổ, cả mảnh phá và thường gây đồng thời nhiều vết thương.

Đối với tuyến cấp cứu kỳ đầu thì băng bó cầm máu, bất động tạm thời, giảm đau, chống choáng là những việc làm quan trọng. Phải hiểu rằng ngoài thương tổn do mảnh phá gây ra, thương tổn do mìn chủ yếu là do sóng nổ. Sóng nổ sẽ gây thương tổn vi thể đối với tế bào, gây tình trạng sưng nề tổ

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chức, thoát huyết tương và rối loại tuần hoàn tại chỗ gây hoại tử thứ phát. Do vây cần phải nhanh chóng chuyển nạn nhân về tuyến bệnh viện để kịp thời xử trí. Phẫu thuật cắt lọc từng vết thương, mở rộng giải chèn ép, cắt cụt chi... là những vấn đề có tính chuyên khoa đối với vết thương do mìn gây ra.

b- Vết thương gãy xương khớp do mìn – For bones and arthrosis broken.

Vết thương có gãy xương do mìn cũng là loại thương tổn hay gặp trong chiến tranh và hay gặp trong cấp cứu thời bình. Diễn biến gãy xương do mìn bao giờ cũng trầm trọng hơn các gãy xương thông thường bởi tính chất của thương tổn. Trong vết thương gãy xương do mìn có hai loại thương tổn là vết thương phần mềm và ổ gãy hở. Gãy xương hở rất dễ bị nhiễm trùng do tình trạng ô nhiễm từ đất đá và đặc biệt là nhiễm trùng kỵ khí. Do sự phù nề, bầm dập tổ chức bởi sóng nổ càng làm cho ổ gãy hở được nuôi dưỡng kém đi.

Đối với vết thương có thấu khớp nghĩa là làm cho ổ khớp thông với bên ngoài cũng là rất thường gặp trong các vết thương do mìn. Ô khớp là một khoang trống, kín nay trở thành nơi chứ đựng tổ chức dập nát, di vật bẩn nên khả năng nhiễm khuẩn rất nhanh. Đối với những khớp lớn như khớp gối, khớp háng thì tình trạng nhiễm khuẩn mủ có thể nguy hại đến cơ thể

Khi nạn nhân bị vướng mìn, ngoài vết thương phần mềm gây chảy máu, chi thể bị biến dạng dù ít hay nhiều vẫn cứ phải nghĩ rằng đã có thương tổn gãy xương để cho thaí độ xử trí nói chung được thận trọng hơn.

- Đặt băng ép kín để cầm máu.
- Bất động tạm thời để vận chuyển. Bất động tốt ổ gãy để tránh di lệch thứ phát, thương tổn thứ phát gây đau đớn và gây sốc chấn thương. Khi bất động nẹp cần chú ý phải bất động đủ độ dài trên và dưới ổ gãy một khớp.
- Tiêm thuôcá giảm đau Promedol 0,02 hoặc Morphin 0,01. Phóng bế Novocain 0,25% vào gốc chi, cho kháng sinh toàn thân, huyết thanh chống uốn ván (SAT 1500 đơn vị). Thuốc trợ tim mạch như Long não, Caphein, Coramin...
- Cho uống nước chè nóng có pha đường, ủ ấm trên dọc đường vận chuyển.

c- Vết thương vùng ngực bụng do mìn – For injuries of chest and abdomen.

So với vết thương ở chi thể thì tỷ lệ vết thương vùng ngực bụng có ít hơn. Đối với các tuyến cấp cứu kỳ đầu cần phải hiểu rằng khi có vết thương thấu bụng hay thấu ngực thì chỉ định mổ cấp cứu đòi hỏi càng nhanh càng tốt. Những nạn nhân bị thương do mìn thường có vết thương ở chi thể là chủ yếu, vết thương ngực bụng thường là kèm theo. Nhưng cũng chính vì thế cần phải cảnh giác trước tình trạng sốc do đa chấn thương gây nên. Công tác phòng chống sốc như giảm đau, an thần, kháng sinh toàn thân sớm, băng bó vết thương phần mềm, bất động tạm thời và vận chuyển nạn nhân nhanh chóng về tuyến sau là những nguyên tắc căn bản.

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4- Kết luận - Conclusion

- Đối với tuyến cấp cứu kỳ đầu khi có vết thương mìn gây ra thì đòi hỏi các cán bộ y tế hiểu rõ một nguyên tắc cơ bản đó là: Tác nhân gây thương tổn của mìn ngoài mảnh phá còn do sóng nổ. Nhiều vết thương đồng thời và những thương tổn thứ phát do sóng nổ gây ra đòi hỏi phải đước sử trí nhanh rồi chuyến nạn nhân về tuyến sau để có những xử trí căn bản đối với từng chuyên khoa.

- Nguyên tắc chung trong điều trị cấp cứu kỳ đầu là phòng chống sốc, băng bất động để cầm máu, giảm đau an thần, kháng sinh toàn thân, phòng chống uốn ván và vận chuyển nạn nhân nhanh chóng về tuyến sau.

II. THE PICTURES OF POSTERS, LEAFLETS, PICTURED BOOK OF THE UXO AWARENESS EDUCATION PROGRAM IN A LUOI.

Those posters were sticked on the wall of the puclic areas in A Luoi.

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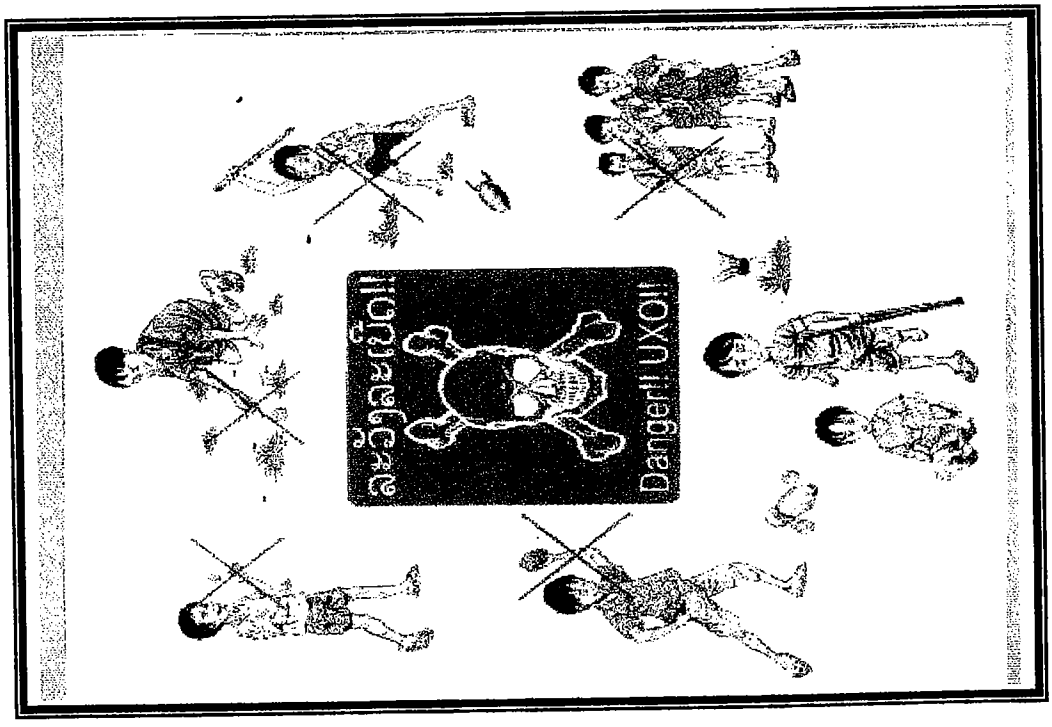
SOME PICTURES OF AWARENESS EDUCATION PROGRAM DONE IN A LUOI IN AUGUST, 2001

BOOK COVER WAS DISTRIBUTED FOR PUPILS



ANNEX IV
SOME PICTURES OF AWARENESS EDUCATION PROGRAM DONE IN A LUOI IN AUGUST, 2001

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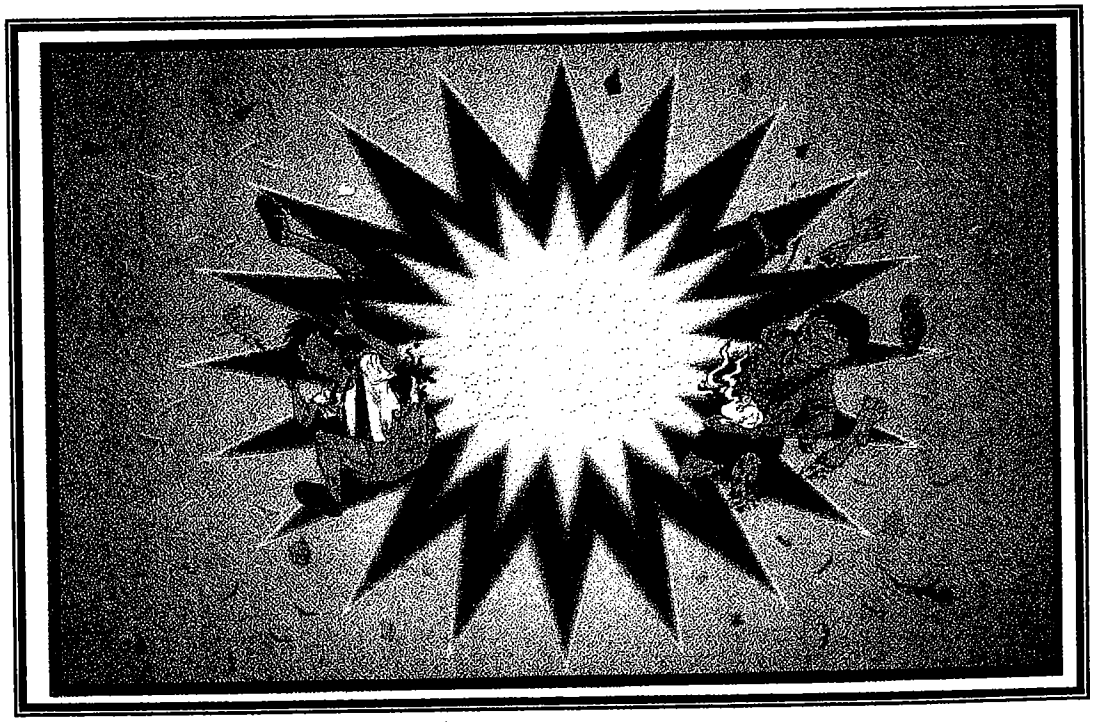

Table A8.1 Soil Standards Defining a Contaminated Site (i.e., values that are equal to or greater than the specified number) (BC Waste Management Act 1996).

NUMERICAL SOIL STANDARDS[1]

Substance	Agricultural	Residential
Inorganic Substances		
Antimony	20	20
Barium	750	500
Beryllium	4	4
Boron (hot water soluble)	2	-
Cobalt	40	50
Cyanide (WAD)[2]	0.5	10
Cyanide (SAD)[3]	5	50
Fluoride	200	400
Mercury	0.8	2
Molybdenum	5	10
Nickel	150	100
Selenium	2	3
Silver	20	20
Sulphur (elemental)	500	-
Thallium[4]	2	-
Tin	5	50
Vanadium	200	200
Monocyclic Aromatic Hydrocarbons (MAHs)		
Styrene	0.1	5
Phenolic Substances		
Nonchlorinated[5] (each)	0.1	1
Chlorophenols[6] (each)	0.05	0.5
Polycyclic Aromatic Hydrocarbons (PAHs)		
Benz[a]anthracene	0.1	1
Benzo[b]fluoranthene	0.1	1
Benzo[k]fluoranthene	0.1	1
Dibenz[a,h]anthracene	0.1	1
Indeno[1,2,3-cd]pyrene	0.1	1
Naphthalene	0.1	5
Phenanthrene	0.1	5
Pyrene	0.1	10
Chlorinated Hydrocarbons		
Chlorinated aliphatics[7] (each)	0.1	5
Monochlorobenzene	0.1	1
dichlorobenzene[8] (each)	.01	1
Chlorobenzenes[9] (each)	0.1	1

Substance	Agricultural	Residential
Hexachlorobenzene	0.05	2
Hexachlorocyclohexane	0.05	-
Petroleum Hydrocarbons		
VPHs[10]	200	200
LEPHs[11]	1,000	1,000
HEPHs[12]	1,000	1,000

1 All values in µg/g unless otherwise stated.

2 WAD means weak acid dissociable.

3 SAD means strong acid dissociable.

4 Standard has been adjusted based on analytical detection limit of 2 µg/g for substance.

5 **Nonchlorinated phenolic substances include**:
2,4-dimethylphenol
2,4-dinitrophenol
2-methyl 4,6-dinitrophenol
nitrophenol (2-, 4-)
phenol
cresol

6 **Chlorophenols include:**
chlorophenol (ortho, meta, para)
dichlorophenol (2,6-, 2,5-, 2,4-, 3,5-, 2,3-, 3,4-)
trichlorophenol (2,4,6-, 2,3,6-, 2,4,5-, 2,3,5-, 2,3,4-, 3,4,5-)
tetrachlorophenol (2,3,5,6-, 2,3,4,5-, 2,3,4,6-)

7 **Aliphatic chlorinated hydrocarbons include:**
chloroform
dichloroethane (1,1-, 1,2-)
dichloroethene (1,1-, 1,2-)
dichloromethane
1,2-dichloropropane
1,3-dichloropropene (cis and trans)
1,1,2,2-tetrachloroethane
carbon tetrachloride
trichloroethane (1,1,1-, 1,1,2-)

8 **Dichlorobenzene includes:**
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene

9 **Chlorobenzene includes:**
trichlorobenzene
tetrachlorobenzene
pentachlorobenzene

10 **VPHs include:**
volatile petroleum hydrocarbons with the exception of benzene, toluene, ethylbenzene, and xylenes.

11 **LEPHs include:**
light extractable petroleum hydrocarbons with the exception of benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenz[a,h]anthracene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene and pyrene.

12 **HEPHs include:**
heavy extractable petroleum hydrocarbons with the exception of benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenz[a,h]anthracene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene and pyrene.

Table A8.2 Soil Standards for Protection of Site-Specific Factors (i.e., human health and environmental protection) (BC Waste Management Act 1996).

NUMERICAL SOIL STANDARD (µg/g dry weight)

Substance and Site-Specific Factor	Agricultural Purposes	Residential Purposes
Arsenic		
Human Health Protection	100	100
Environmental Protection	35	35
Benzene		
Human Health Protection	1,000	1,000
Environmental Protection	80	80
Benzo[a]pyrene (B[a]P)		
Human Health Protection	5	5
Environmental Protection	0.1	1
Cadmium		
Human Health Protection[1]	3 or 35	3 or 35
Environmental Protection	250	250
Chromium		
Human Health Protection (Chromium 6)	150	150
Environmental Protection (Total chromium)	750	250
Copper		
Human Health Protection	15,000	15,000
Environmental Protection	150	150
Ethylbenzene		
Human Health Protection	3,500	3,500
Environmental Protection	0.1	5
Lead		
Human Health Protection	500	500
Environmental Protection	1,000	1,000
Pentachlorophenol		
Human Health Protection	1,000	1,000
Environmental Protection	20	20
Polychlorinated Biphenyls (PCBs)[2]		
Human Health Protection	5	5
Environmental Protection	0.5	5

[1] If soil to be used to grow produce for human consumption, 3 µg/g applies; if not, 35 µg/g applies.

[2] Polychlorinated biphenyls (PCBs) include Arochlor mixtures 1242, 1248, 1254 and 1260.

Appendix A9

Determining the Health Risk of Chemical Contamination Found in UXO Clearance Areas

APPENDIX A9

DEFOLIANT HERBICIDE DIOXINS

Soils

Given their low water solubility and resistance to rapid degradation, dioxins (particularly 2,3,7,8-tetrachlorodibenzo-*p*-dioxin [TCDD]) tend to partition into soil; consequently, this medium serves as a "reservoir" for the contaminant and effectively serves to facilitate the contamination of other media long after cessation of a contaminating activity and/or process has occurred (Webster and Commoner 1994).

In the United States, the Agency for Toxic Substances and Disease Registry (ATSDR 1998) reports that TCDD is not generally detected in rural soils; however, in industrialized regions of the US, TCDD levels typically range from 1.0 pg/g to 10 pg/g. The International Agency for Research on Cancer (IARC 1997) provides a detailed summary of 42 studies in 18 industrialized countries presenting over 150 TCDD data points. TCDD concentrations presented in this overview ranged from non detect to 9.6×10^9 pg/g; the highest concentrations recorded in the IARC summary were found in highly contaminated soils from Missouri (e.g., a horse arena and farm soil, Kimbrough *et al.* 1997 and Viswanthan *et al.* 1995, both *cited in* IARC 1997). Other very high TCDD levels (i.e., >1,000 pg/g) were recorded in soils collected from heavily industrialized sites; these sites included manufacturing plants for tetrachlorophenol, pentachlorophenol, chlorophenolics, herbicides (e.g., 2,4-D) and incineration facilities.

Regulatory agencies addressing human health protection have employed various protocols to address the issue of dioxin contamination (e.g., in Canada, Health Canada and provincial health ministries and environmental departments; in the US, the Environmental Protection Agency [EPA] and state health agencies).

In British Columbia (BC), Canada, legislation addresses the issues of contaminated sites and legal standards directed at site remediation. The definition of a "contaminated site" (i.e., soil) in BC is one in which:

> *"…the concentration of any substance in the soil at the site is greater than or equal to… the lowest value of the applicable matrix numerical soil standards…"* (BC Waste Management Act 1996).

Most accepted global standards/guidelines for dioxin and other chemicals have been developed for western lifestyles and assume quality housing, low direct contact with soil, availability of a wide variety of food sources, good potable water quality and populations that are relatively free from serious disease, malnutrition or chronic illnesses (e.g., water-borne diseases, vitamin deficiencies, etc.).

Rural people in Viet Nam do not have the lifestyles of most westerners. In fact, they live in continuous close contact with the soil, generally consume a narrow variety of foods grown locally, and experience numerous health problems related to water-borne disease and malnutrition.

Western dioxin standards/guidelines for health and environmental protection are, therefore, likely not conservative enough to protect risk to health in rural Viet Nam. Given the rural Viet Nam socioeconomic situation, such standards should be more stringent. However, developing new standards for application in developing countries where people are still living off the land, would be a long and likely controversial process.

It is recommended, therefore, that existing western standards/guidelines should be initially used to determine when special UXO clearing procedures should be taken in chemically contaminated soils in Viet Nam. Using such an approach will prioritize areas which require the most urgent attention in dealing with the UXO clearing problem in chemically contaminated soils.

For soils contaminated with polychlorinated dioxins and polychlorinated furans (PCDD and PCDF, respectively), legal total toxic equivalence (T-TEQ) standards are set, which if exceeded would designate a site to be a "contaminated site". For example, in BC, the land categories of "agricultural and residential/park" are recognized in legislation. The site-specific receptors that define the legal threshold contaminant level for the land categories considered in agricultural and residential land are "human health protection" and "environmental protection" (i.e., ecological health). The following is the BC PCDD/PCDF (expressed as T-TEQ) soil standards for agricultural and residential/park soils (source: BC Waste Management Act 1996):

Matrix Numerical Soil Standard (pg/g Total TEQ).

Site-Specific Factor/Receptor	Agricultural Land	Residential/Park Land
Human Health Protection[1]	350	350
Environmental Protection	10	1,000

[1] An adult is used as the critical receptor, and related to intake (ingestion) of contaminated soil.

When addressing the issue of ecological health (environmental protection), the agricultural land and residential/park categories have different levels, 10 pg/g and 1,000 pg/g T-TEQ, respectively.

When addressing human health protection in BC, T-TEQ for agricultural and residential/park soils is 350 pg/g for both categories. This value is calculated on the basis of oral ingestion of soils alone, and does not make provision for dioxins that may be taken into the body through other avenues (e.g., foods, drinking water, exposure to commercial products, etc; BC Environment 1996).

These values focus on adult individuals with an assumed soil ingestion rate of 20 mg/day (BC Environment 1996). The following provides a summation of typical soil ingestion rates for the

general population in Canada (source: Angus Environmental 1991, Newhook 1992 and MENVIQ 1992, *cited in* BC Environment 1996):

Typical Average Receptor Characteristic Values for the Canadian General Population.

Age Classes (years)	Soil Intake (mg/day)
0-0.5	20
0.6-4	80
5-11	20
12-19	20
20+	20

It should be noted here that young children are believed to ingest more soil materials and, generally, have greater exposure to soil contaminants relative to adults. Their lower body weight is also a factor. The above table would undoubtedly be magnified for young children in many third world countries as they are more intimately associated with soil as a result of dress (e.g., usually lacking footwear) and play habits (particularly the very young living in poor villages who spend time on bare ground), which increase the opportunity to ingest soil. In addition, many houses have dirt floors.

When a given area is to be assessed and categorized as to whether or not it constitutes a contaminated site in BC, two receptor categories (human health and ecological health, see table on previous page) are always considered. However, if a land category is designated as contaminated by either standard and remediation is contemplated, the BC Waste Management Act (1996) stipulates that the "lowest" matrix numerical soil standard be applied; that is, if a property is to be remediated for agricultural purposes, the 10 pg/g T-TEQ level for PCDDs/PCDFs is the target (remediation measures must reduce the soil contaminate level below 10 pg/g T-TEQ). Similarly, if land is to be remediated solely for the purposes of residential/park use, 350 pg/g T-TEQ is the target criterion.

The question may be posed: if the ecological health receptor level is 10 pg/g T-TEQ for agricultural land, and the human health receptor level is 350 pg/g T-TEQ, is not more importance being placed on the ecological elements as opposed to human elements of the environment? The rationale for the difference in T-TEQ relates to the issues of bioaccumulation and biomagnification. Agricultural areas are used for raising food (crops and livestock); these foods are ultimately consumed by humans, therefore, directly facilitating dioxin bioaccumulation and biomagnification processes. Since it is important to protect crops, livestock, and human health, a more stringent standard has been designated for ecological health.

A similar rationale is in place for residential/park lands. Given that residential/park areas are not major food producing regions, the ecological health standard is set at 1,000 pg/g T-TEQ. The direct ingestion of soil contaminants is considered a greater probability (and greater potential hazard) in residential/park situations relative to the possibility of ingestion from foods produced

in these areas. The quantity of foods produced in a residential/park area is markedly less than on agricultural lands, hence the 1,000 pg/g and 10 pg/g levels, respectively.

The Canadian Council of Ministers of the Environment (CCME 1999), a joint federal-provincial Canadian agency, has set a guideline for PCDDs and PCDFs (T-TEQ) for land used in agricultural areas at 10 pg/g T-TEQ, and for residential/park land at 1,000 pg/g T-TEQ; only a single value is presented for each land category. In Canadian provinces, where contaminated site legislation is available, the provincial regulatory standards take precedence over CCME guidelines. The CCME (1999) T-TEQ values for agricultural and residential/park land use are recommended for remediation quality (i.e., remediation should be equal to or less than the value).

In the US, the Environmental Protection Agency (EPA) works to protect public health and the environment. Regarding soils and contaminant levels, for example, the US EPA Region III (Delaware, Maryland, Pennsylvania, Virginia, West Virginia and District of Columbia) has set a TCDD level (not T-TEQ level as in BC Canada) of 4.3 pg/g as a residential soil guideline (a level for agricultural soil does not exist) and 38.0 pg/g for industrial soil (US EPA 1999a). If soil values exceed these guidelines, a risk assessment is required.

In US EPA Region IX (Arizona, California, Nevada, Hawaii, US Territories of Guam and American Samoa, and the Commonwealth of the Northern Marianna Islands, and other unincorporated US Pacific possessions), the soil guidelines for TCDD are 3.9 pg/g and 27 pg/g for residential and industrial soils, respectively (US EPA 1999b).

Some differences related to assumed dioxin exposure, and thus guideline values, exist between Regions III and IX; however, it can be accepted that the residential soil guideline is relatively low (4.3 pg/g and 3.9 pg/g TCDD, respectively).

The ATSDR (1997) guideline for dioxin and dioxin-like compounds in residential soils has been set at 50 pg/g T-TEQ. The guideline states that in residential regions where soil T-TEQ levels exceed 50 pg/g, a further site-specific evaluation is required. The ATSDR (1997) indicates that if a soil dioxin level is <50 pg/g T-TEQ, a more detailed site-specific assessment may still be required based on overall community health concerns and a health assessor's concerns regarding other combinations of potential contaminants. In addition, if an exposure pathway is identified (e.g., food chain pathway), the extent of exposure and public health implications are required to be further evaluated. The likelihood, frequency, routes and exposure levels to the contaminant, and information on human populations that are exposed, would require assessment.

The ATSDR (1997) guideline recommends that an area with a soil concentration of >50 pg/g to <1,000 pg/g T-TEQ should undergo the following evaluation:

- bioavailability;
- ingestion rates;
- pathway analyses;
- soil cover;
- climate;

- other contaminants;
- community concerns;
- demographics; and
- background exposures.

ATSDR (1997) also recommends that if soil levels are ≥1,000 pg/g T-TEQ, public health actions should be considered, such as:

- surveillance;
- research;
- health studies;
- community;
- education, and
- exposure investigations.

Essentially, health assessors should obtain a sufficiently detailed database to enable a judgement regarding assessment of the site as a public health hazard, thereby facilitating implementation of public health recommendations to prevent human exposure, which includes clean-up of the contaminated site.

As noted, if dioxin contamination in soils exceeds existing standards/guidelines, appropriate changes in procedures for UXO clearance should be implemented (see Section 5.7).

Through effective UXO clearing and erosion control practices, the re-mobilization of soil chemicals through widespread broadcasting during clearance can be prevented/minimized. It is probable that some contaminated soil will be dispersed beyond the immediate clearance area (several meters). The application of techniques that would direct run off away from significant food producing areas (e.g., aquaculture ponds) should be common practice, particularly in highly contaminated areas.

Food Chain

The toxicity of dioxins, TCDD specifically, and PCDDs/PCDFs in general, has prompted organizations such as the World Health Organization (WHO) and various countries to develop and adopt tolerable daily intake (TDI)[1] or allowable daily intake (ADI) levels for PCDDs/PCDFs in foods, based on TCDD toxic equivalents (NATO 1998a,b,c).

The Canadian and the Japanese governments are presently applying a TDI value of 10 pg TEQ/kg body weight/day (10 pg TEQ/kg bw/d) (IARC 1997, Health Canada 1996, Government of Canada 1993). This value was originally recommended by the WHO (WHO/EURO 1991)

[1] TDI = an intake rate considered safe for humans.

based on liver toxicity, reproductive effects and immunological effects, in addition to employing information on kinetics in humans and experimental animals.

In Germany, 10 pg TEQ/kg bw/d is also being used at present, wherein if a daily intake exceeds this value for an extended period of time, immediate actions are necessary to counter exposure (Schultz 1994).

The Netherlands uses a more restrictive TDI of 2-3 pg TEQ/kg bw/d (Birnbaum and Slezak 1999). Patandin *et al.* (1999a) indicate that the TDI for the Netherlands is, in fact, lower than that reported by Birnbaum and Slezak (1999); they report the TDI as being 1 pg TEQ/kg bw/d. The US Environmental Protection Agency (US EPA) has proposed a virtually safe dose of 0.0064 pg TEQ/kg bw/d (Patandin *et al.* 1999a, McLachlan 1993), a markedly lower value relative to those quoted above.

The WHO has recently revised the recommended TDI, reducing the value from 10 pg TEQ/kg bw/d to a range of 1-4 pg TEQ/kg bw/d (WHO/EURO 1998a,b) based on new epidemiological and toxicological data, particularly information focussing on neurodevelopment and endocrinological effects.

The following is presented as an example of a TDI application for assessing whether a given level of contamination warrants initiation of a risk assessment/risk management process, which could involve food consumption advisories.

In Canada, the 10 pg TEQ/kg bw/d is the upper threshold which, if exceeded on a regular basis, triggers implementation of a risk assessment/management process. For foods, a standard weight of an individual consumer is set at 60 kg. The probable daily intake (PDI) of animal liver/fat tissues is set at 20 g tissue/day; for animal muscle tissue the PDI is set at 40 g tissue/day. Therefore, if one wishes to determine the concentration (i.e., Total TEQ) of PCDDs/PCDFs in a given tissue sample that equates to 10 pg TEQ/kg bw/d (which constitutes the upper threshold level), the following approach is applied:

Liver and Fatty Tissues

$$\frac{(x)(20\ g/d)}{60\ kg} = 10\ pg\ TEQ/kg\ bw/d$$

$$(x)(20\ g/d) = (10\ pg\ TEQ/d)(60)$$

$$(x)(20\ g/d) = (600\ pg\ TEQ/d)$$

$$x = \frac{600\ pg\ TEQ/d}{20\ g/d}$$

$$x = 30\ pg\ TEQ/g$$

where: x = Total TEQ of a liver/fat sample which would be equivalent to 10 pg TEQ/kg bw/d for a 60 kg person consuming 20 g of tissue per day.

A similar calculation using muscle tissue at a set consumption rate of 40 g/day results in a Total TEQ of 15 pg/g as the upper threshold level.

Therefore, if either the 30 pg/g Total TEQ in animal liver or fat, or 15 pg/g Total TEQ in muscle tissue is exceeded for a tissue sample, the risk assessment/management process is activated in Canada.

If the new WHO TDI is accepted and applied to the above example, the 30 pg/g threshold is reduced to 12 pg/g, and the 15 pg/g threshold for muscle would be reduced to 6 pg/g.

If following an assessment of food contaminant data, it is concluded that levels exceed risk thresholds, mitigative measures should be implemented to protect human health.

Humans

Humans are at the top of their food chain and will bioaccumulate and biomagnify certain chemical contaminants (particularly the organic pollutants – e.g., dioxin, PCBs, pesticides). Blood, milk and fatty tissues can serve as monitors of environmental condition.

If it is found that, for example, human blood has a dioxin level (particularly TCDD) which exceeds 3-7 pg/g (a typical range in industrialized countries), efforts should be expended to protect people from further exposure to contaminated foods.

The class of chemical compounds known as organochlorines, of which PCDDs/PCDFs are a member, have been recognized as teratogens (i.e., involved in the production of abnormal organisms) (Dietrich 1999). PCDDs/PCDFs are considered persistent and toxic with the source being contaminated foods (Patandin *et al.* 1999a). The nursing of infants reduces the maternal body burden of PCDDs/PCDFs at the expense of the infant (Schecter *et al.* 1998, Abraham *et al.* 1998, 1996, Raum *et al.* 1998, Schecter *et al.* 1996, Schecter *et al.* 1990a, Furst *et al.* 1989).

It has generally been concluded that breast-fed infants can be considered a high risk group in the human population for PCCD/PCDF exposure (Dahl *et al.* 1995, Jensen 1987). These compounds have elicited concern for the overall health of infants, particularly if breast milk comprises a high proportion of the infant diet (Raum *et al.* 1998).

Breast milk is a reliable indicator of PCDD/PCDF levels in adipose tissue. This medium provides a reliable matrix for investigations regarding the degree of exposure to contaminants such a PCDDs/PCDFs (Noren 1993, Rappe 1992). Concentrations in breast milk also compare well to those in human blood (Papke 1999a,b, 1998); however, Schecter *et al.* (1991b) found that levels of PCDDs/PCDFs (including T-TEQs) are somewhat higher in blood compared to milk.

In general, PCDDs/PCDFs in human breast milk are higher in industrialized countries (Schecter *et al.* 1996, Schecter *et al*. 1989d), when compared to developing regions of the world. Human breast milk contaminated with PCDDs/PCDFs, essentially reflects levels of local contamination.

In Canada, a TDI (Tolerable Daily Intake) of 10 pg TEQ/kg bw/d is recognized for the protection of human health. The most recent recommendation of the World Health Organization

(WHO) is that the TDI be reduced to a maximum of 4 pg TEQ/kg bw/d, with efforts being made immediately to reduce the level to a maximum of 1 pg TEQ/kg bw/d for the protection of human health.

In order to calculate the average daily intake, the WHO (WHO/EURO 1989) has recommended a constant set of parameters be applied to the calculation; these include milk consumption by the infant at 700 mg/d (700 ml/d), infant weight of 5 kg and a percent milk fat of 3.5%.

Breast feeding has been recognized as being beneficial to infants (Hooper *et al.* 1998, Huisman *et al.* 1995b, Jensen and Slorach 1991, WHO/EURO 1988); some of these benefits include the passage of immunological factors to the infant, creating a bonding between mother and infant, reducing the risk of allergic reactions, providing virtually all the nutrition necessary during earlier months, and serving as a contraceptive.

Information on the benefits of breast feeding has resulted in recommendations by numerous researchers that breast feeding continues, given that the benefits appear to outweigh the health risks, at least at this point in time (Patandin *et al.* 1999b, Schade and Heinzow 1998, Lutter *et al.* 1998, Wise 1997, Albers *et al.* 1996, Rogan 1996, 1991, Huismann *et al*. 1995b, Tarkowski and Yrjanheikki 1989). Notably, the added caution accompanying the above recommended continuation of breast feeding is that concerted efforts should be made to reduce exposure to toxic chemicals to further reduce potential health risks; these efforts should include controlling the source(s) of such contaminants (Brouwer *et al.* 1998, Abraham *et al.* 1996, Schuhmacher *et al.* 1999, Somogyi and Beck 1993).

OTHER CHEMICALS COMMONLY USED ON FORMER BASES

Soils

Determining if levels of contamination by chemicals commonly used or produced at former military bases can only be done in a general way for each chemical.

Table A8.1 (Appendix A8) summarizes the legal soil standards in British Columbia, Canada (BC Waste Management Act 1966). Soil data that are equal to or greater than those stated in Table 1, indicate the existence of a "contaminated site" for these chemicals. These values can serve as a guide for planning of UXO clearing at sites having these chemicals.

Table A8.2 (Appendix A8) summarizes specific chemicals that are categorized as influencing human and environmental health. Levels are set for agriculture and residential land uses.

If an area is to be remediated, given exceedances of soil standards, the practice is to focus on the lowest level for the contaminant. Any remediation measures must reduce soil contaminants to below the soil standard.

It should be noted that the site-specific factor of "human health protection" is based on the "intake of contaminated soils".

Food Chain

If the non-defoliant chemical contaminated area is used for food production and/or people live in the immediate vicinity, samples of produce (livestock, poultry and fish) should be collected for chemical analyses. Protocols presented for food sample collection for defoliated chemicals should be applied.

The following provides a guideline for specific chemicals in foods, related to protection of human health:

- Mercury – levels should not exceed 0.5 µg/g (wet weight) (Health Canada);
- Lead – levels should not exceed 0.8 µg/g (wet weight) (BC Ministry of Environment);
- Benzo[a]pyrene (a polyaromatic hydrocarbon) – levels should not exceed 0.004 µg/g (wet weight) (BC Ministry of Environment);
- PCBs – levels should not exceed 2.0 µg/g (wet weight, BC Ministry of Environment); levels should not exceed a tolerable daily intake of 1.0 µg/kg body weight per day (Health Canada);
- DDT plus metabolites – levels should not exceed 20 µg/kg body weight per day (Health Canada).

If levels of the above chemicals are exceeded in animal tissues collected from a contaminated site, mitigative measures should be implemented to reduce the risk to human health.

CHEMICALS FROM UNEXPLODED ORDNANCE

UXO, over time, may experience the release of some of the explosive materials into surrounding soils. Most explosive compounds are crystalline solids with low water solubility (Noyes 1996). Environmental release of these materials would result from casings being broken upon impact when the ordnance failed to detonate. Since most UXO are positioned within two feet of the surface, some excavation will be necessary to expose contaminated soils. Given explosive materials are hazardous for long periods of time, there is a risk of detonation if an irritating source were applied to even a single crystal or explosive chunk (e.g., heat under confinement; Noyes 1996).

A risk to human health may occur through soil exposure pathways of dust inhalation, ingestion and dermal absorption. Avoiding these scenarios are critical during UXO removal in soils contaminated with these energetic materials.

Appendix A10

Overview Paper on Hatfield Consultants Ltd.'s Agent Orange Project in Viet Nam

PATTERNS OF HUMAN EXPOSURE TO AGENT ORANGE TCDD IN SOUTHERN VIET NAM

Paper Presented at:

- Viet Nam – United States Scientific Conference on Human Health and Environmental Effects of Agent Orange/Dioxin (Ha Noi, Viet Nam; March 2002)
- International Conference on the Long-Term Environmental Consequences of the Viet Nam War (Stockholm, Sweden; July 2002)
- International Conference on the Ecological and Health Effects of the Viet Nam War (Yale University, New Haven, Connecticut; September 2002)
- Rockefeller University, New York (September 2002)

HATFIELD
CONSULTANTS LTD.

PATTERNS OF HUMAN EXPOSURE TO AGENT ORANGE TCDD IN SOUTHERN VIET NAM

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1.0 Introduction

In 1963, the US military initiated use of herbicides in Viet Nam for general defoliation and crop destruction (IOM, 2001). Application of herbicides was primarily through cargo aircraft (C-123s), and ground mechanisms (i.e., trucks, backpack sprayers, and riverboats). Over 72 million litres of herbicide were applied over southern Viet Nam (Westing, 1984; IOM, 1994); applications ceased in 1971.

Sixty-one percent of the herbicide used in Viet Nam was Agent Orange, a 50/50 mixture of 2,4-dichlorophenoxyacetic acid (2,4-D), and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T). The 2,4,5-T fraction of the Agent Orange mixture contained an initially unknown chemical 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD).

Military installations throughout southern Viet Nam (e.g., Bien Hoa, Da Nang, Nha Trang, and Phu Cat) served as bulk storage and supply facilities for Agent Orange (US Army documents, 1969; Cecil, 1986). These storage sites experienced spills of herbicide. In 1970, a 7,500 US gallon spill of Agent Orange occurred on the Bien Hoa base. Between January and March 1970, three other spills of lesser volume occurred at Bien Hoa (US Army documents, 1970).

As a consequence of the aerial applications and handling of Agent Orange on military installations, there exist two primary sources of major TCDD contamination in Viet Nam – from spray missions by C-123 aircraft, and contamination on former US military installations where herbicide was stored, dispensed, and spilled.

Our investigations extended from 1994-2001 in the Aluoi Valley of central Viet Nam, situated approximately 65 km west of Hue (Hatfield Consultants and 10-80 Committee, 1998, 2000; Dwernychuk et al., 2002).

The Aluoi Valley was an integral portion of the Ho Chi Minh Trail. The valley had three US Special Forces bases and was extensively sprayed with Agent Orange between 1965 and 1970 (Fig. 1). Aluoi and Ta Bat bases were closed in 1965, being operational for less than one year. The A So base (formerly known as the A Shau Special Forces base), remained operational from 1963 to 1966 (Stanton, 1985). Agent Orange was stored and used on the A So base during its operation (US Army documents, 2001).

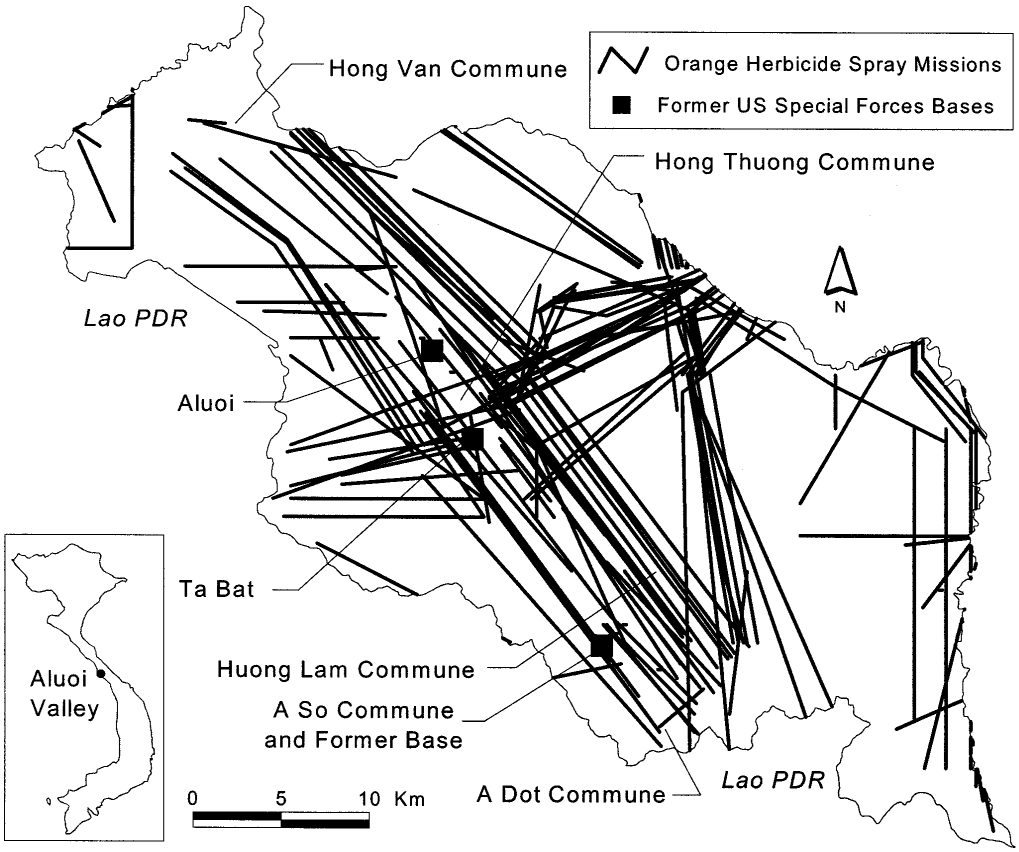

Fig. 1. Communes and Agent Orange aerial spray missions, Aluoi Valley, Viet Nam, 1965-1970 (Source: US Dept. of the Army).

The Aluoi Valley provided an ideal location to compare the long-term consequences of Agent Orange in areas that received aerial applications, and areas used for storage/dispensing of the herbicide (i.e., former US military installations).

2.0 Materials and Methods

2.1 Soil

Soil samples, using a stainless steel core, were collected throughout the valley. Cores were of the 0-10 cm depth fraction. At any given site, ten subsample cores were collected, composited, and thoroughly mixed to represent a single sample for laboratory analysis.

Regions of the valley aerially sprayed by C-123 aircraft were sampled along the main access road extending from the A Dot commune in the south, through Hong Van commune in the north (Fig. 1). Hong Van received the least amount of aerial applications of Agent Orange, and served as an "in-valley" reference site for our studies. A total of 9 analytical soil samples were prepared from each of the three former Special Forces bases (Fig. 1).

In 1996 and 1997, sediments were also collected from fish ponds excavated in the soils of the former A So base.

2.2 Plant and Animal Materials

Rice, manioc and vegetable oil samples were collected from residents throughout the valley. Ducks, chickens, cultured fish, wild fish, pork and beef were purchased from valley residents. All dissections of animal tissues were undertaken at our field headquarters.

2.3 Human Blood and Breast Milk

In 1997, whole blood was collected from A So residents (maximum of 3.5 mL per person). In 1999, blood was collected from residents of A So, Houng Lam, Hong Thuong and Hong Van (Fig. 1). People were grouped according to sex and age (i.e., ≥25 years of age [born before or during the war] and <25 years of age [born after the war]).

In 2001, 636 whole blood samples were collected from residents of four communes in the Aluoi Valley employing the age/sex categories of earlier programs.

Four lactating primaparous females from each of the four communes listed above donated breast milk (15-50 mL) in 1999. Additional milk sampling was undertaken in 2001. Sixteen lactating primaparous females from the four communes of interest provided samples (four per commune).

All samples (blood and milk) were frozen within one hour of sampling.

2.4 Laboratory Analysis

Soil, food, blood and milk samples were processed in Canada at AXYS Analytical Services, Sidney, British Columbia, a World Health Organization certified laboratory (WHO/EURO, 2001). Analysis occurred using high resolution gas chromatography with high resolution mass spectrometric detection (HRGC/HRMS). Total toxic equivalents for analyzed samples were calculated employing the "international" dioxin TEQ (I-TEQ; NATO, 1988).

3.0 Results

3.1 Soil

TCDD levels in the soils of the three former Special Forces bases were elevated when compared to soils from areas of the Aluoi Valley that received aerial applications of Agent Orange.

The highest TCDD levels were recorded at A So, 897.85 pg/g (Total I-TEQ, 901.22 pg/g; Fig. 2). The grid sampling pattern employed on the bases in 1999 yielded TCDD concentrations at A So, which indicated the highest levels of contamination were located along the northern sector of the former base (i.e., 220 pg/g, 360 pg/g, and 260 pg/g; Fig. 2). CORONA spy satellite imagery and declassified documents from the US military revealed the base layout, with evidence of those areas probably used for storage and/or handling of Agent Orange; these being situated in the northern sector of the base (US Army documents, 2001).

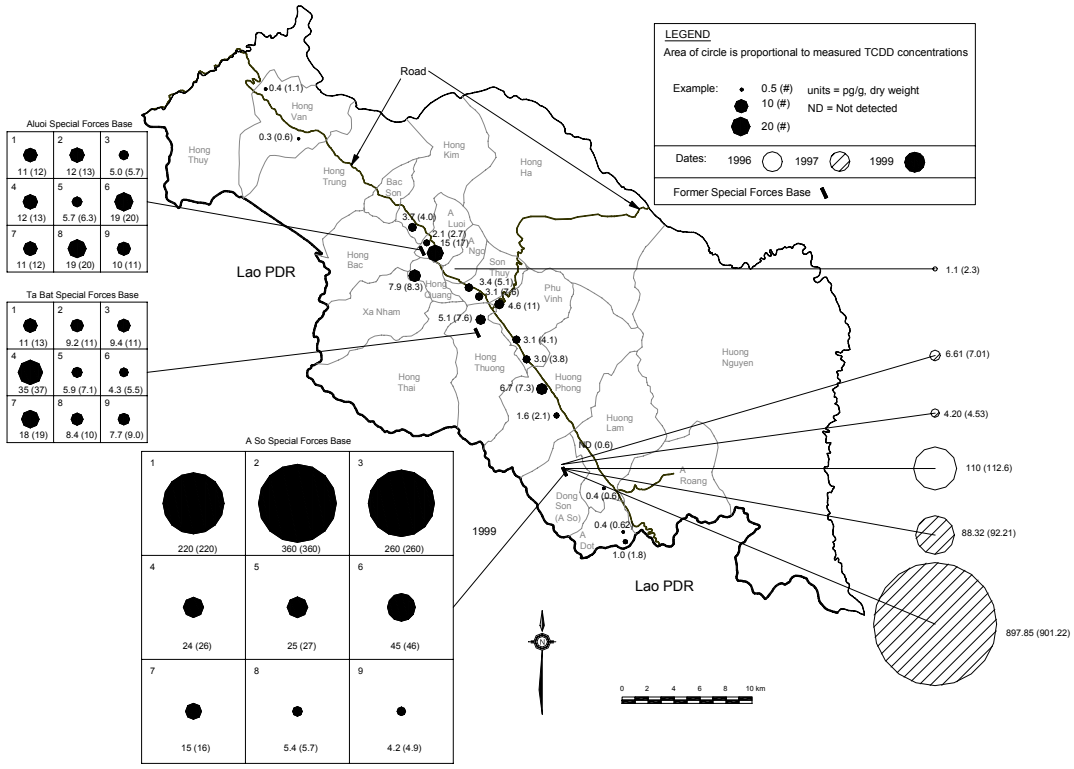

Fig. 2. TCDD (pg/g dry weight) in soils (0-10 cm depth), Aluoi Valley, Viet Nam, 1996-1999; parenthesis enclose Total I-TEQ levels.

Aluoi and Ta Bat Special Forces bases were operational for less than one year, while A So was operational for approximately three years. Even though the two short-lived bases did not experience on-site military activity for a duration comparable to A So, TCDD contamination, generally, was higher than that measured in soils along the valley bottom where aerial

applications of Agent Orange had occurred (Fig. 2). Soil TCDD levels on the Aluoi base ranged from 5.0 pg/g to 19 pg/g; on the Ta Bat base, 4.3 pg/g to 35 pg/g.

The Total I-TEQs of soils, particularly those from the former bases, reflected the high contribution of TCDD to the Total I-TEQ calculation (approximately 83% to >99% TCDD contribution to Total I-TEQs). These high percentages leave little doubt that Agent Orange was the origin of TCDD contamination in the region.

The highest TCDD levels along the valley bottom, sprayed by C-123 aircraft, was 15 pg/g (Total I-TEQ, 17 pg/g). Other values along the valley bottom ranged from non-detect (ND) to 7.9 pg/g (Fig. 2).

TCDD at levels of 1.8 pg/g, 5.2 pg/g, 5.4 pg/g, 8.5 pg/g and 6.9 pg/g were detected in bottom sediments of fish ponds excavated on the former A So base. The percent TCDD contribution to Total I-TEQs of these sediment samples ranged from 88% to 92.4%, indicative of Agent Orange involvement in the contamination of these ponds.

3.2 Plant and Animal Foods

TCDD was not detected in rice, manioc and vegetable oil samples collected from the valley (Fig. 3).

The highest levels of TCDD were detected in fish and duck fat samples from the A So commune (Fig. 3), the highest TCDD level being 82 pg/g in 1999 (Total I-TEQ, 87 pg/g).

Fish fat samples from A So in 1996 and 1997 also yielded elevated levels, 51 pg/g (Total I-TEQ, 53.7 pg/g) and 34 pg/g (Total I-TEQ, 35.4 pg/g), respectively (Fig. 3). Other fish and duck samples from the A So commune were elevated when compared to samples collected from other regions throughout the valley. Fish and duck tissues collected from A So commune, the site of the former Special Forces base, had markedly higher levels of TCDD contamination relative to other communes in the valley.

Total I-TEQ levels in the majority of animal tissues, particularly samples from the A So commune, exceeded the revised World Health Organization (WHO) consumption guidelines[a] and, in some instances, the more liberal Canadian threshold[b].

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[a] WHO range of 3-12 pg/g Total I-TEQ based on a revised TDI of 1-4 pg I-TEQ/kg body weight/day (WHO/EURO, 1998 a, b).

[b] 30pg/g Total I-TEQ maximum based on a TDI of 10 pg I-TEQ/kg body weight/day (Health Canada, 1996). This guideline is presently under review.

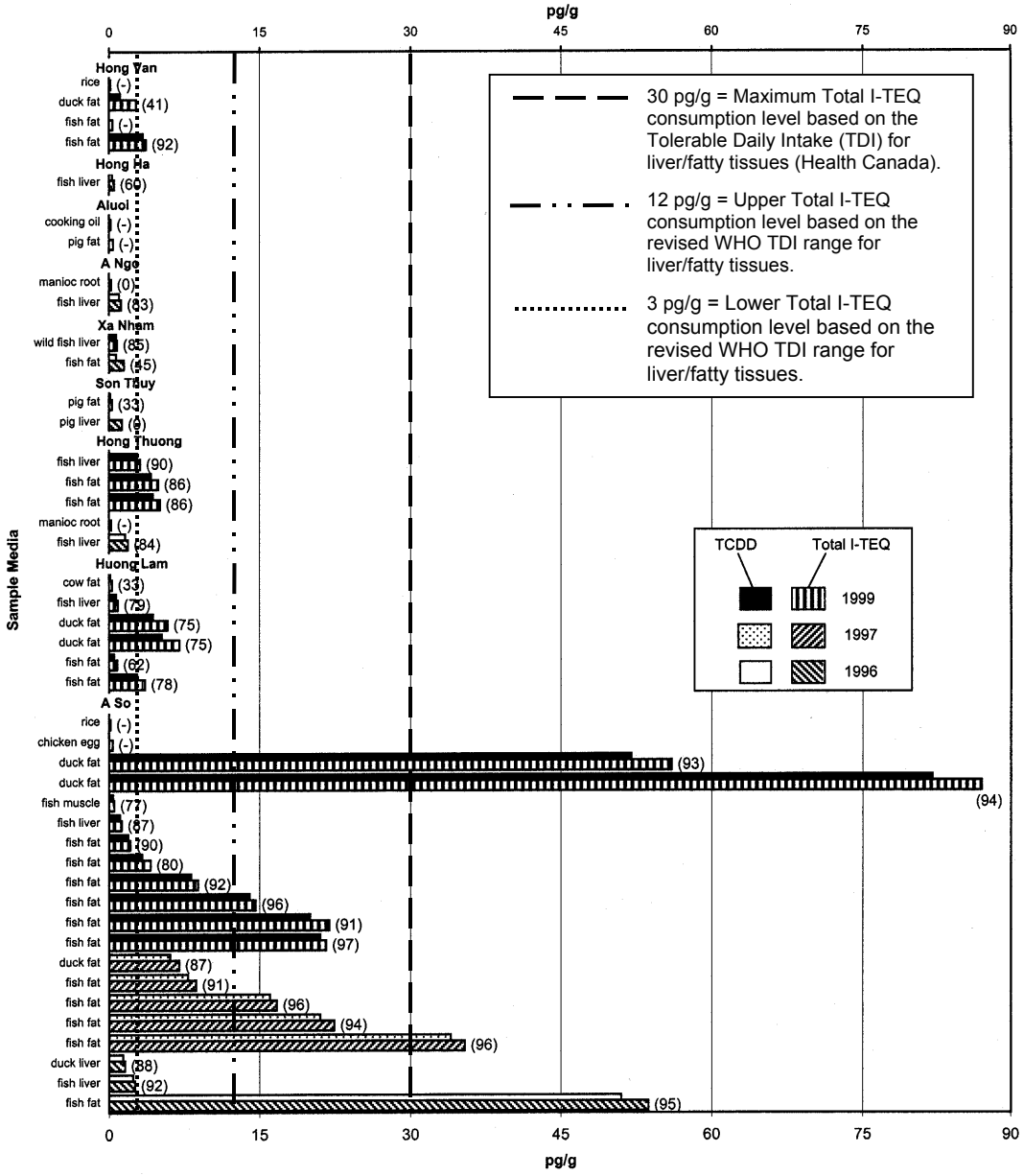

Fig. 3. TCDD and Total I-TEQ in plant (pg/g dry weight) and animal tissues (pg/g wet weight) sampled from Aluoi Valley communes, Viet Nam, 1996, 1997 and 1999. Parentheses enclose percent contribution of TCDD to Total I-TEQ.

3.3 Human Blood

In 1997, TCDD in human blood from A So was males (≥25 years of age) 31 pg/g lipid, males (<25 years of age) 21 pg/g lipid, females (≥25 years of age) 11 pg/g lipid, and females (<25 years of age) 12 pg/g lipid. The number in each pooled sample was 50 individuals. TCDD contribution to Total I-TEQ for these data are 83%, 82%, 77% and 78%, respectively.

In 1999, a total of 556 donors were involved in the whole blood sampling program for the Aluoi Valley in 1999 (Table 1). The highest TCDD level was measured in males ≥25 years of age, those inhabiting A So commune (41 pg/g lipid). A So males in the <25 years of age category had 31 pg/g lipid TCDD. Those individuals (males and females) living on the former base at A So had higher levels of TCDD in their blood, relative to other communes ($p<0.01$; Student-Newman-Keuls Test; Hicks, 1973). Males, in general, had higher TCDD levels than females ($p = 0.001$). This probably resulted from their higher caloric intake, greater exposure to contaminated soils, and a practice of living off the land when away from home for days.

Table 1. TCDD (pg/g lipid) in pooled whole human blood, Aluoi Valley, Viet Nam, 1999.

Commune and Donor (years of age)	# in Pool	TCDD (pg/g lipid)[a]	Total I-TEQ	TCDD as % of Total I-TEQ
A So				
Males (≥25)	48	41	45.9	89.3
Males (<25)	30	31	35.0	88.6
females (≥25)	44	16	18.3	87.4
females (<25)	41	14	16.6	84.3
Huong Lam				
males (≥25)	31	17	25.6	66.4
males (<25)	33	9.0	19.8	45.5
females (≥25)	29	5.3	22.0	24.1
females (<25)	27	ND	10.0	-
Hong Thuong				
males (≥25)	43	21	32.3	65.0
males (<25)	27	8.6	15.1	57.0
Females (≥25)	37	12	24.6	48.8
Females (<25)	25	7.6	11.5	66.1
Hong Van				
males (≥25)	37	ND	5.41	-
males (<25)	40	NDR	7.67	-
Females (≥25)	27	ND	5.95	-
Females (<25)	37	ND	3.53	-

[a] ND = Not detected; for 'Total I-TEQ' calculations, if ND, ½ detection level was used.

NDR = A chromatographic peak was detected but did not meet quantification criteria; for Total I-TEQ calculations, NDR was treated as ND.

Older individuals in 1999 had higher levels of TCDD ($p = 0.019$), given their exposure has been for a longer duration. Younger people (<25 years of age, born after the war) also had clearly elevated levels. There was little variation in TCDD levels between the two age categories of females, particularly at A So. This apparent lack of difference may be the result of younger females becoming lactating mothers early in life, while older females are continuing to give birth to children and off-loading TCDD during breast feeding (Schecter et al., 1998; Abraham et al., 1998).

The relatively high percent of TCDD contribution to Total I-TEQs, particularly in samples from the former A So base, indicates Agent Orange involvement in contamination of local foods.

Preliminary data from analyses of blood samples collected during the 2001 program, indicate a similar pattern of TCDD contamination (related to age, sex and commune) as that recorded during earlier programs.

3.4 Human Breast Milk

Sixteen primaparous mothers ranging in age from 17 to 28, donated milk at a time when they were breastfeeding infants; infants ranged in age from 20 days to one year (Table 2).

Table 2. TCDD in human breast milk (pg/g lipid) and average daily intake (pg I-TEQ/kg body weight/day) of polychlorinated dibenzodioxins and polychlorinated dibenzofurans by infants from primaparous mothers, Aluoi Valley, Viet Nam, 1999.

Commune	Donor Age	Age of Child and Duration of Breastfeeding[a]	% Lipid	TCDD (pg/g)	Total I-TEQ (pg/g)	TCDD as % of Total I-TEQ	Intake[b] Total I-TEQ
A So	22	1 y	5.6	5.5	6.15	89.4	30.1
	20	1 m	4.5	19.0	21.9	86.4	107.3
	18	1 y	4.0	18	18.7	96.3	91.6
	23	5 m	3.3	16	18.8	85.1	92.1
Huong Lam	23	7 m	1.3	12	14.6	82.2	71.5
	19	8 m	3.7	8.3	10.2	81.4	50.0
	28	3 m	3.6	2.9	10.6	27.4	51.9
	21	20 d	1.7	5.8	9.33	62.2	45.7
Hong Thuong	17	5 m	1.6	11	17.2	64.0	84.3
	21	6 m	1.4	8.7	12.6	69.0	61.7
	22	1 y	2.7	7.7	9.73	79.1	47.7
	19	2 m	2.1	11	18.5	59.5	90.7
Hong Van	20	5 m	2.7	3.3	5.07	65.1	24.8
	23	2 m	2.1	2.2	3.85	57.1	18.9
	20	1 m	3.2	5.0	13.2	37.9	64.7
	19	1 m	1.8	1.4	3.0	46.8	14.7

[a] y = year, m = months, d = days.

[b] Average daily intake via human milk based on a 5 kg infant consuming 700 ml of milk per day with a lipid content of 3.5 % (WHO/EURO, 1989).
Average daily intake = (volume of milk per day in ml)x(% lipid in milk/100)x(concentration of chemical in pg/g)/(infant weight in kg).

The highest levels of TCDD were measured in mothers' milk from the A So commune (19.0 pg/g lipid, 18.0 pg/g lipid, and 16.0 pg/g lipid). Although A So breast milk had the highest levels of TCDD, levels were not statistically different from Houng Lam or Hong Thuong; however, A So levels were significantly higher when compared to Hong Van, the area receiving

the least amount of Agent Orange applications ($p < 0.01$; Student-Newman-Keuls Test; Hicks, 1973).

Hong Thuong TCDD levels were significantly greater than those recorded at Hong Van ($p < 0.05$). Hong Lam TCDD levels in breast milk were significantly greater than those recorded at Hong Van ($p < 0.05$).

The lack of apparent difference between some sites may have resulted from the fact that contaminants like TCDD can be eliminated from the body through lactation (Abraham et al., 1998; Raum et al., 1998). The relatively high percent contribution of TCDD to the Total I-TEQ, particularly in milk samples collected from A So, indicate an Agent Orange source for TCDD.

The revised Tolerable Daily Intake (TDI) value set by the World Health Organization (WHO/EURO, 1998a,b), 1-4 pg/g I-TEQ/kg bw/d, are greatly exceeded, particularly in calculations based on breast milk TCDD levels from the A So commune (Table 2). The highest level of exceedance, relative to the revised WHO TDI is the 20 year old mother whose calculated release to her infant is 107.3 pg I-TEQ/kg bw/d. The lowest intake value occurred in Hong Van, 14.7 pg I-TEQ/kg bw/d (Table 2). All breast milk samples from the Aluoi Valley exceeded the WHO TDI for dioxins.

Preliminary data from analyses of the 2001 milk samples indicate a similar pattern of TCDD contamination as that recorded in 1999 (i.e., highest TCDD levels in milk from A So mothers).

4.0 Discussion

During the Viet Nam conflict, the US and south Vietnamese military established numerous military installations throughout southern Viet Nam (e.g., artillery bases, communication bases, etc.). Use and storage of Agent Orange on these facilities occurred (US Army documents, 1969, 1970). The storage areas for herbicides experienced spills, which prompted recommendations addressing these occurrences (US Army documents, 1969). Recommendations regarding the handling of Agent Orange on storage/dispensing facilities included the construction of drainage ditches, spill ponds, and systems comparable to septic field distribution for spilled herbicides. These action protocols were probably in place at many of the Agent Orange storage centres.

Agent Orange was also sprayed throughout southern Viet Nam, covering approximately 10% of the landmass (IOM, 1994). The two most prominent modes of Agent Orange release to the Vietnamese environment were, therefore, through aerial application and ground activities that occurred in and around various military installations.

Soils, foods and humans in the Aluoi Valley, as evidenced by levels in blood and breast milk, are contaminated with TCDD. However, those environmental samples and human tissues collected from the former US Special Forces base at A So had the highest levels of TCDD contamination, relative to other former bases (occupied for a shorter period of time), and areas of the valley that received aerial applications of Agent Orange.

We theorize that the pattern of TCDD contamination recorded in the Aluoi Valley serves as a model for contamination throughout southern Viet Nam. Human exposure, and subsequent contamination through the food chain transfer of TCDD, would be highest in areas of former military installations where significantly higher concentrations of TCDD may be residing in soils relative to sprayed areas. Soils in regions aerially sprayed would not have experienced the same loading of Agent Orange, and therefore TCDD, as military bases.

Schecter et al. (2001) sampled near the former Bien Hoa base, and measured very high levels of TCDD in soils (e.g., 1,164,699 pg/g dry weight) and in human blood (e.g., 271.1 pg/g lipid). These levels are undoubtedly related to the Agent Orange spill at Bien Hoa in 1970 (US Army documents, 1970), particularly when considering that the soil TCDD contributed 99% of the toxicity to the Total I-TEQ; for blood, TCDD contributed 92% of the Total I-TEQ for the very high sample. These data further strengthen our theory.

A review of blood data from Viet Nam (Fig. 4), on the basis of TCDD expressed as a percent of the Total I-TEQ, indicates that the highest percentages (and corresponding Agent Orange responsibility), occur at the former military installations at A So (Aluoi Valley) and Bien Hoa where more comprehensive investigations have been undertaken.

As a result of our Aluoi Valley studies, we recommended the following actions that have been implemented by Vietnamese authorities:

- relocate villagers living on the A So base to avoid further TCDD contamination;
- limit further human settlement on the A So base area;
- deactivate aquaculture ponds on the A So base where fish have been raised for food;
- implement advisories and health protocols regarding potentially contaminated foods (e.g., proper cleaning and peeling of vegetables, discarding fatty tissues and the internal organs of fish and ducks); and
- distribute educational material (e.g., printed and video materials) to Aluoi Valley schools and residents regarding dioxin contamination.

In order to utilize and extend the Aluoi Valley experience to other regions of southern Viet Nam, and address the threat of risk to human health in other potential hot spots, we further recommend:

- a systematic review of US military archives to determine the location of probable Agent Orange storage/use on bases in southern Viet Nam;
- soils, foods and the human population should be tested, if evidence suggests TCDD contamination in the area;

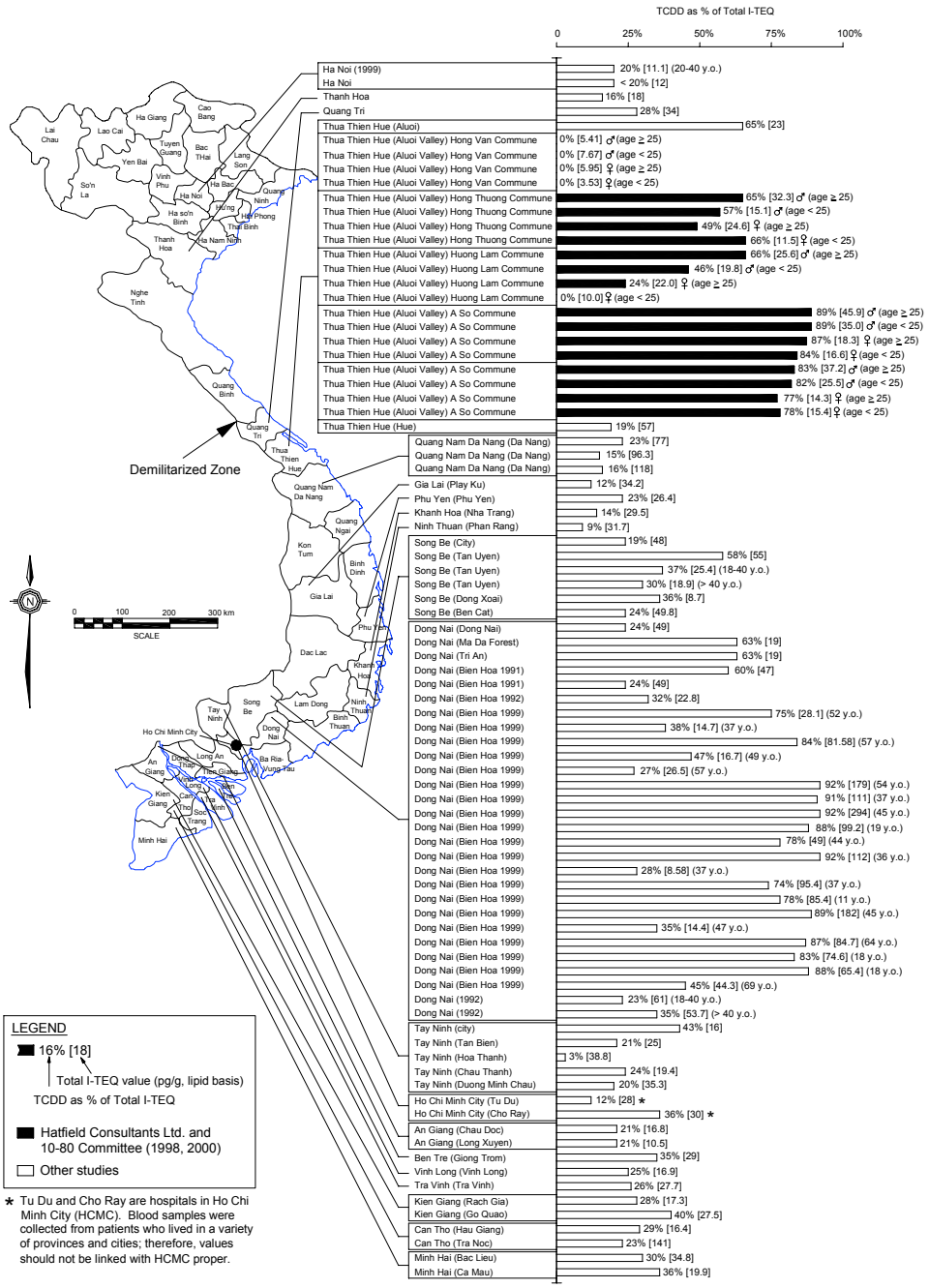

Fig. 4. TCDD as % of Total I-TEQ in human blood from localities in Viet Nam, 1987 to 1999 (Dai et al., 1994, 1995; Schecter et al., 1992, 2001; Schecter, 1994), and 1997 and 1999 (Hatfield Consultants and 10-80 Committee, 1998, 2000; Dwernychuk et al., 2002).

- crash sites and load-jettison sites of Agent Orange spray aircraft should be investigated;
- assistance be provided to the Vietnamese to implement investigative strategies for identification of potentially contaminated areas; and

- assistance be provided to the Vietnamese to immediately implement health protection measures where TCDD levels are found to be above western standards/guidelines (e.g., monitor aquaculture ponds, discard tissues of fish and ducks that have a high probability of contamination, proper cleaning/peeling of in-ground vegetables, etc.);

The following overview summarizes the unique elements of the Hatfield Agent Orange project in Viet Nam:

1. TCDD migration – *confirmed through the food chain*: In a single localized area of Viet Nam, TCDD, originating from use of the defoliant Agent Orange, was followed in its migration from contaminated soils, into the food chain, and into humans. This is the first comprehensive systematic investigation of Agent Orange which has directly quantified TCDD movement within the ecosystem of a small prescribed geographical area of the country.

2. Former military installations – *proven "hot spots"*: Through comparative studies of aerially sprayed lands and three former military bases in the predetermined area of Aluoi Valley, the TCDD "hot spot" theory was proven quantitatively. As a consequence and with the highest priority, research and intervention must be directed at all former military installations where historical records of overt and covert operations reveal the storage and/or use of Agent Orange.

3. TCDD standards exceeded – *immediate intervention required:* Hatfield has demonstrated that in hot spots, TCDD levels in soils and food exceed international standards and guidelines which are used to protect human health; therefore, in proven hot spots we state emphatically that no additional research on human health is required to facilitate intervention to protect local citizenry.

4. Mitigation strategy – *recommended and implemented:* As a consequence of quantifying TCDD levels in the environment and humans living in a specific area of Viet Nam, a mitigation strategy was recommended and implemented to protect human health. The intervention strategy has wide applicability and serves as a model for all of southern Viet Nam.

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Appendix A11

Dioxin/Furan Laboratory Analysis Reports

Section 1: Human Tissue Analyses – Health Canada Laboratory, Ottawa, Ontario, Canada

Section 2: Soil Analyses – AXYS Laboratory, Sidney, British Columbia, Canada

Section 1: Human Tissue Analyses Health Canada Laboratory, Ottawa, Ontario, Canada

Table A11.1 Dioxins and furans (ppt lipid); Whole Human Blood; Dong Son, Aluoi Valley, Viet Nam, August 2001.

	Location	Dong Son	Dong Son	Dong Son	Dong Son
	Field Number	M≥25 Comp 1	M<25 Comp 2	F≥25 Comp 3	F<25 comp 4
	MS Data file	S01110811	S01110810	S01110809	S01110808
	Lab #	PM114-6	PM114-7	PM114-8	PM114-9
	No. of individual samples in composites	50	35	44	45
	Sample Weight g	222.63	159.75	178.94	183.72
	Fat Weight g	0.729	0.494	0.520	0.516
	Fat %	0.330	0.310	0.290	0.280
	Sex/Age	males ≥ 25	males < 25	females ≥ 25	females < 25
I-TEF	Analyte				
1	2,3,7,8-TCDD	20.63	14.09	8.62	9.38
0.5	1,2,3,7,8-PnCDD	2.39	2.39	1.17	nd(0.80)
0.1	1,2,3,4,7,8-HxCDD	1.21	0.97	0.77	nd(0.70)
0.1	1,2,3,6,7,8-HxCDD	5.24	4.47	1.61	2.29
0.1	1,2,3,7,8,9-HxCDD	1.94	2.03	0.81	nd(0.78)
0.01	1,2,3,4,6,7,8-HpCDD	8.65	7.53	6.07	5.14
0.001	OCDD	37.75	38.62	31.54	33.15
0.1	2,3,7,8-TCDF	0.63	1.09	0.80	nd(0.68)
0.05	1,2,3,7,8-PnCDF	0.51	nd(0.29)	nd(0.24)	nd(0.45)
0.5	2,3,4,7,8-PnCDF	4.45	4.83	1.75	2.17
0.1	1,2,3,4,7,8-HxCDF	18.45	14.38	7.07	9.28
0.1	1,2,3,6,7,8-HxCDF	10.84	8.43	3.78	3.94
0.1	2,3,4,6,7,8-HxCDF	0.72	1.06	0.50	nd(0.68)
0.1	1,2,3,7,8,9-HxCDF	nd(0.28)	nd(0.36)	nd(0.44)	nd(0.88)
0.01	1,2,3,4,6,7,8-HpCDF	18.28	18.92	11.92	13.62
0.01	1,2,3,4,7,8,9-HpCDF	3.72	3.74	2.96	3.10
0.001	OCDF	nd(0.43)	0.80	nd(0.77)	nd(1.6)
	I-TEQ				
	Toxicity PCDD	22.79	16.15	9.62	9.96
	Toxicity PCDF	5.55	5.16	2.27	2.70
	Toxicity PCDF/PCDD	28.34	21.31	11.89	12.66

Table A11.2 Dioxins and furans (ppt lipid); Whole Human Blood; Huong Lam, Aluoi Valley, Viet Nam, August 2001.

	Location	Huong Lam	Huong Lam	Huong Lam	Huong Lam
	Field Number	M≥25 Comp 5	M<25 Comp 6	F≥25 Comp 7	F<25 Comp 8
	MS Data file	S01110807	S01110806	S01112004	S01112005
	Lab #	PM114-10	PM114-11	PM115-2	PM115-3
	No. of individual samples in composites	52	53	39	35
	Sample Weight g	242	244	151	141
	Fat Weight g	0.624	0.519	0.550	0.530
	Fat %	0.260	0.210	0.363	0.377
	Sex/Age	males ≥ 25	males < 25	females ≥ 25	females < 25
I-TEF	Analyte				
1	2,3,7,8-TCDD	10.29	8.40	5.02	3.52
0.5	1,2,3,7,8-PnCDD	4.09	3.73	nd(1.0)	1.25
0.1	1,2,3,4,7,8-HxCDD	3.17	2.30	1.35	nd(1.4)
0.1	1,2,3,6,7,8-HxCDD	10.16	7.76	3.70	2.06
0.1	1,2,3,7,8,9-HxCDD	3.29	2.99	1.54	nd(1.5)
0.01	1,2,3,4,6,7,8-HpCDD	16.52	15.15	10.05	6.20
0.001	OCDD	91.68	82.73	49.74	44.10
0.1	2,3,7,8-TCDF	nd(0.99)	1.09	nd(0.88)	nd(1.0)
0.05	1,2,3,7,8-PnCDF	0.78	nd(0.62)	nd(0.75)	nd(0.65)
0.5	2,3,4,7,8-PnCDF	6.80	6.90	3.74	2.10
0.1	1,2,3,4,7,8-HxCDF	32.09	28.71	18.21	9.35
0.1	1,2,3,6,7,8-HxCDF	20.71	15.36	9.36	5.55
0.1	2,3,4,6,7,8-HxCDF	1.27	1.06	1.05	nd(0.77)
0.1	1,2,3,7,8,9-HxCDF	nd(0.71)	nd(0.72)	nd(0.85)	nd(1.0)
0.01	1,2,3,4,6,7,8-HpCDF	41.91	36.53	24.22	16.64
0.01	1,2,3,4,7,8,9-HpCDF	7.38	7.48	4.98	1.89
0.001	OCDF	nd(1.1)	nd(1.3)	1.61	nd(1.6)
	I-TEQ				
	Toxicity PCDD	14.25	11.80	6.08	4.60
	Toxicity PCDF	9.42	8.57	5.13	2.88
	Toxicity PCDF/PCDD	23.68	20.37	11.21	7.48

Table A11.3 Dioxins and furans (ppt lipid); Whole Human Blood; Hong Thuong, Aluoi Valley, Viet Nam, August 2001.

	Location	Hong Thuong	Hong Thuong	Hong Thuong	Hong Thuong
	Field Number	M≥25 Comp 9	M<25 Comp 10	F≥25 Comp 11	F<25 Comp 12
	MS Data file	S01112006	S01112007	S01112008	S01112009
	Lab #	PM115-4	PM115-5	PM115-6	PM115-7
	No. of individual samples in composites	34	34	26	23
	Sample Weight g	163	165	97.00	90
	Fat Weight g	0.579	0.523	0.351	0.347
	Fat %	0.356	0.317	0.361	0.385
	Sex/Age	males ≥ 25	males < 25	females ≥ 25	females < 25
I-TEF	Analyte				
1	2,3,7,8-TCDD	7.76	5.47	6.70	5.07
0.5	1,2,3,7,8-PnCDD	2.69	2.12	1.81	1.28
0.1	1,2,3,4,7,8-HxCDD	1.38	0.75	1.08	nd(0.65)
0.1	1,2,3,6,7,8-HxCDD	8.51	4.08	3.72	4.41
0.1	1,2,3,7,8,9-HxCDD	3.02	1.51	1.11	1.51
0.01	1,2,3,4,6,7,8-HpCDD	15.11	6.97	8.60	9.91
0.001	OCDD	78.29	57.33	66.09	146.93
0.1	2,3,7,8-TCDF	nd(0.60)	0.57	nd(0.71)	0.76
0.05	1,2,3,7,8-PnCDF	nd(0.44)	nd(0.55)	nd(0.69)	nd(0.55)
0.5	2,3,4,7,8-PnCDF	5.15	2.99	2.52	3.05
0.1	1,2,3,4,7,8-HxCDF	22.04	7.12	7.29	13.78
0.1	1,2,3,6,7,8-HxCDF	11.88	4.30	4.21	6.73
0.1	2,3,4,6,7,8-HxCDF	0.83	nd(0.42)	0.63	0.73
0.1	1,2,3,7,8,9-HxCDF	nd(0.67)	nd(0.55)	nd(0.63)	nd(0.65)
0.01	1,2,3,4,6,7,8-HpCDF	17.63	8.09	9.46	14.15
0.01	1,2,3,4,7,8,9-HpCDF	2.63	nd(0.91)	nd(0.97)	2.41
0.001	OCDF	nd(0.90)	nd(0.60)	nd(0.90)	nd(0.87)
	I-TEQ				
	Toxicity PCDD	10.63	7.11	8.35	6.58
	Toxicity PCDF	6.33	2.84	2.66	3.94
	Toxicity PCDF/PCDD	16.96	9.95	11.01	10.52

Table A11.4 Dioxins and furans (ppt lipid); Whole Human Blood; Hong Thuy, Aluoi Valley, Viet Nam, August 2001.

	Location	Hong Thuy	Hong Thuy	Hong Thuy	Hong Thuy
	Field Number	M≥25 Comp 13	M<25 Comp 14	F≥25 Comp 15	F<25 Comp 16
	MS Data file	S01112010	S01112011	S01112105	S01112106
	Lab #	PM115-8	PM115-9	PM115-10	PM115-11
	No. of individual samples in composites	65	44	33	24
	Sample Weight g	314	214	128.30	86
	Fat Weight g	0.769	0.573	0.468	0.313
	Fat %	0.245	0.268	0.365	0.365
	Sex/Age	males ≥ 25	males < 25	females ≥ 25	females < 25
I-TEF	Analyte				
1	2,3,7,8-TCDD	3.38	2.63	2.33	1.25
0.5	1,2,3,7,8-PnCDD	2.25	1.45	0.97	nd(1.1)
0.1	1,2,3,4,7,8-HxCDD	1.31	1.06	nd(0.71)	nd(1.3)
0.1	1,2,3,6,7,8-HxCDD	5.58	2.84	2.16	nd(1.4)
0.1	1,2,3,7,8,9-HxCDD	2.04	1.18	1.46	nd(1.5)
0.01	1,2,3,4,6,7,8-HpCDD	9.43	11.93	4.48	3.46
0.001	OCDD	71.82	91.58	33.63	28.30
0.1	2,3,7,8-TCDF	1.11	0.51	0.74	nd(0.88)
0.05	1,2,3,7,8-PnCDF	2.70	nd(0.58)	0.56	0.78
0.5	2,3,4,7,8-PnCDF	5.30	2.88	1.98	1.40
0.1	1,2,3,4,7,8-HxCDF	18.56	11.18	6.64	4.92
0.1	1,2,3,6,7,8-HxCDF	13.18	7.33	4.27	3.11
0.1	2,3,4,6,7,8-HxCDF	1.98	0.38	1.23	0.65
0.1	1,2,3,7,8,9-HxCDF	nd(0.38)	nd(0.41)	nd(0.60)	nd(0.75)
0.01	1,2,3,4,6,7,8-HpCDF	18.39	13.65	10.80	11.99
0.01	1,2,3,4,7,8,9-HpCDF	3.81	3.28	2.21	5.27
0.001	OCDF	3.88	3.65	1.49	6.10
	I-TEQ				
	Toxicity PCDD	5.56	4.07	3.29	1.80
	Toxicity PCDF	6.51	3.59	2.47	1.87
	Toxicity PCDF/PCDD	12.07	7.66	5.76	3.67

Table A11.5 Dioxins and furans (ppt lipid); Human Breast Milk; Dong Son, Aluoi Valley, Viet Nam, August 2001.

	Location	Dong Son	Dong Son	Dong Son	Dong Son
	Field number	01VN001	01VN013	01VN017	01VN024
	MS Data File	S01102502	S01102503	S01102504	S01102505
	Lab #	PM113-2	PM113-3	PM113-4	PM113-5
	Sample Weight g	23.32	23.65	28.98	31.41
	Fat Weight g	0.597	0.779	0.555	0.490
	Fat %	2.56	3.29	1.91	1.56
	Sex/Field number	female 01VN001	female 01VN013	female 01VN017	female 01VN024
I-TEF	Analyte				
1	2,3,7,8-TCDD	5.16	11.57	2.33	15.38
0.5	1,2,3,7,8-PnCDD	0.19	0.32	nd(0.27)	0.33
0.1	1,2,3,4,7,8-HxCDD	0.64	0.55	nd(0.60)	0.80
0.1	1,2,3,6,7,8-HxCDD	1.79	1.32	nd(0.90)	1.92
0.1	1,2,3,7,8,9-HxCDD	0.34	nd(0.18)	nd(0.70)	nd(0.3)
0.01	1,2,3,4,6,7,8-HpCDD	1.27	1.50	0.38	2.71
0.001	OCDD	3.92	3.92	4.43	7.05
0.1	2,3,7,8-TCDF	0.04	nd(0.10)	nd(0.18)	nd(0.17)
0.05	1,2,3,7,8-PnCDF	0.02	0.08	nd(0.20)	0.21
0.5	2,3,4,7,8-PnCDF	0.82	0.90	nd(0.18)	1.01
0.1	1,2,3,4,7,8-HxCDF	4.33	1.98	0.62	4.31
0.1	1,2,3,6,7,8-HxCDF	2.27	1.59	1.36	2.89
0.1	2,3,4,6,7,8-HxCDF	0.19	0.20	nd(0.76)	0.29
0.1	1,2,3,7,8,9-HxCDF	0.13	nd(0.08)	nd(0.87)	0.23
0.01	1,2,3,4,6,7,8-HpCDF	3.92	1.07	1.15	3.78
0.01	1,2,3,4,7,8,9-HpCDF	1.34	0.76	1.00	1.75
0.001	OCDF	nd(0.77)	nd(0.58)	nd(1.5)	nd(1.3)
	I-TEQ				
	Toxicity PCDD	5.55	11.95	3.54	15.86
	Toxicity PCDF	1.16	0.86	0.36	1.35
	Toxicity PCDF/PCDD	6.71	12.80	3.90	17.21

Table A11.6 Dioxins and furans (ppt lipid); Human Breast Milk; Huong Lam, Aluoi Valley, Viet Nam, August 2001.

	Location	Huong Lam	Huong Lam	Huong Lam	Huong Lam
	Field number	01VN030	01VN033	01VN035	01VN041
	MS Data File	S01102506	S01102507	S01102508	S01102509
	Lab #	PM113-6	PM113-7	PM113-8	PM113-9
	Sample Weight g	32.92	31.13	35.53	27.52
	Fat Weight g	0.935	0.929	0.606	0.832
	Fat %	2.84	2.98	1.71	3.02
	Sex/Field number	female 01VN030	female 01VN033	female 01VN035	female 01VN041
I-TEF	Analyte				
1	2,3,7,8-TCDD	1.34	2.76	2.76	2.42
0.5	1,2,3,7,8-PnCDD	0.13	0.70	nd(0.26)	nd(0.95)
0.1	1,2,3,4,7,8-HxCDD	0.59	1.36	1.02	nd(0.86)
0.1	1,2,3,6,7,8-HxCDD	1.45	2.58	1.81	0.91
0.1	1,2,3,7,8,9-HxCDD	nd(0.1)	0.20	nd(0.35)	nd(0.93)
0.01	1,2,3,4,6,7,8-HpCDD	0.66	3.25	1.51	1.60
0.001	OCDD	10.96	23.38	7.90	6.89
0.1	2,3,7,8-TCDF	nd(0.05)	nd(0.059)	nd(0.16)	nd(0.66)
0.05	1,2,3,7,8-PnCDF	nd(0.059)	0.29	0.18	nd(0.38)
0.5	2,3,4,7,8-PnCDF	1.03	2.36	1.68	0.31
0.1	1,2,3,4,7,8-HxCDF	2.30	6.57	7.01	0.96
0.1	1,2,3,6,7,8-HxCDF	1.57	3.74	3.88	1.06
0.1	2,3,4,6,7,8-HxCDF	0.12	0.35	0.44	nd(0.39)
0.1	1,2,3,7,8,9-HxCDF	nd(0.053)	0.11	nd(0.12)	nd(0.45)
0.01	1,2,3,4,6,7,8-HpCDF	1.42	3.50	1.97	0.75
0.01	1,2,3,4,7,8,9-HpCDF	0.46	1.12	0.66	nd(0.73)
0.001	OCDF	nd(0.36)	nd(0.34)	nd(0.94)	nd(4.7)
	I-TEQ				
	Toxicity PCDD	1.63	3.58	3.15	2.86
	Toxicity PCDF	0.94	2.32	2.02	0.45
	Toxicity PCDF/PCDD	2.57	5.90	5.18	3.31

Table A11.7 Dioxins and furans (ppt lipid); Human Breast Milk; Hong Thuong, Aluoi Valley, Viet Nam, August 2001.

	Location	Hong Thuong	Hong Thuong	Hong Thuong	Hong Thuong
	Field number	01VN046	01VN048	01VN052	01VN053
	MS Data File	S01102510	S01102511	S01102512	S01102513
	Lab #	PM113-10	PM113-11	PM113-12	PM113-13
	Sample Weight g	29.30	30.29	16.73	21.64
	Fat Weight g	1.248	0.606	0.663	0.657
	Fat %	4.26	2.00	3.96	3.04
	Sex/Field number	female 01VN046	female 01VN048	female 01VN052	female 01VN053
I-TEF	Analyte				
1	2,3,7,8-TCDD	8.21	3.84	3.48	3.36
0.5	1,2,3,7,8-PnCDD	2.18	0.67	0.14	0.29
0.1	1,2,3,4,7,8-HxCDD	1.10	1.30	0.81	0.62
0.1	1,2,3,6,7,8-HxCDD	8.94	3.61	2.71	3.17
0.1	1,2,3,7,8,9-HxCDD	1.54	0.38	nd(0.91)	nd(0.91)
0.01	1,2,3,4,6,7,8-HpCDD	4.27	4.21	8.42	14.82
0.001	OCDD	32.68	22.29	63.05	97.82
0.1	2,3,7,8-TCDF	0.10	nd(0.50)	nd(0.45)	nd(0.46)
0.05	1,2,3,7,8-PnCDF	0.36	0.59	nd(0.26)	nd(0.27)
0.5	2,3,4,7,8-PnCDF	5.36	3.32	1.07	0.91
0.1	1,2,3,4,7,8-HxCDF	15.39	13.45	6.61	4.08
0.1	1,2,3,6,7,8-HxCDF	8.07	7.45	3.80	2.55
0.1	2,3,4,6,7,8-HxCDF	0.37	0.84	0.39	0.24
0.1	1,2,3,7,8,9-HxCDF	nd(0.21)	0.25	0.11	nd(0.40)
0.01	1,2,3,4,6,7,8-HpCDF	6.31	7.45	9.65	3.26
0.01	1,2,3,4,7,8,9-HpCDF	0.90	2.37	4.03	0.62
0.001	OCDF	nd(1.7)	nd(3.6)	nd(3.3)	nd(3.3)
	I-TEQ				
	Toxicity PCDD	10.53	4.77	4.10	4.18
	Toxicity PCDF	5.17	4.01	1.79	1.23
	Toxicity PCDF/PCDD	15.70	8.78	5.89	5.41

Table A11.8 Dioxins and furans (ppt lipid); Human Breast Milk; Hong Thuy, Aluoi Valley, Viet Nam, August 2001.

	Location	Hong Thuy	Hong Thuy	Hong Thuy	Hong Thuy
	Field number	01VN087	01VN088	01VN094	01VN097
	MS Data File	S01110704	S01110705	S01110706	S01110812
	Lab #	PM114-2	PM114-3	PM114-4	PM114-5
	Sample Weight g	20.42	16.76	27.08	16.16
	Fat Weight g	1.011	0.781	0.880	1.100
	Fat %	4.95	4.66	3.25	6.81
	Sex/Field number	female 01VN087	female 01VN088	female 01VN094	female 01VN097
I-TEF	Analyte				
1	2,3,7,8-TCDD	1.41	1.09	1.46	2.32
0.5	1,2,3,7,8-PnCDD	0.47	0.58	0.55	0.74
0.1	1,2,3,4,7,8-HxCDD	0.41	0.63	0.31	0.42
0.1	1,2,3,6,7,8-HxCDD	1.25	1.71	0.49	1.20
0.1	1,2,3,7,8,9-HxCDD	nd(0.50)	0.58	nd(0.33)	0.51
0.01	1,2,3,4,6,7,8-HpCDD	1.47	4.49	0.71	1.79
0.001	OCDD	8.42	26.26	6.40	10.71
0.1	2,3,7,8-TCDF	1.00	0.38	0.41	0.45
0.05	1,2,3,7,8-PnCDF	nd(0.28)	nd(0.22)	nd(0.25)	0.29
0.5	2,3,4,7,8-PnCDF	1.32	1.13	0.77	1.50
0.1	1,2,3,4,7,8-HxCDF	4.26	5.26	0.95	4.51
0.1	1,2,3,6,7,8-HxCDF	1.85	2.38	0.66	2.15
0.1	2,3,4,6,7,8-HxCDF	nd(0.35)	nd(0.26)	nd(0.25)	0.34
0.1	1,2,3,7,8,9-HxCDF	nd(0.44)	nd(0.34)	nd(0.32)	nd(0.15)
0.01	1,2,3,4,6,7,8-HpCDF	2.01	3.69	0.42	1.99
0.01	1,2,3,4,7,8,9-HpCDF	0.62	1.19	nd(0.55)	0.84
0.001	OCDF	nd(1.0)	nd(0.75)	nd(0.81)	0.46
	I-TEQ				
	Toxicity PCDD	1.87	1.75	1.84	2.93
	Toxicity PCDF	1.44	1.45	0.63	1.55
	Toxicity PCDF/PCDD	3.31	3.20	2.47	4.48

Section 2: Soil Analyses – AXYS Laboratory, Sidney, British Columbia, Canada

BATCH SUMMARY

Batch ID: DXWG5389	***Date:*** 19-January-2002
Analysis Type: Dioxin/Furan	***Matrix Type:*** Solid

BATCH MAKEUP

Contract: 2607 ***Samples:*** L4110-1
L4110-2
L4110-3
L4110-4
L4110-5
L4110-6

Blank: WG5389-101

Reference or Spike: WG5389-102

Duplicate:

Comments:

1.

ANALYSIS REPORT
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS

CLIENT SAMPLE I.D.:	**Spiked Matrix**	**AXYS FILE:**	**WG5389-102**
CLIENT:	**Hatfield Consultants Ltd**	**DATE:**	**19-Jan-2002**
CLIENT NO.:	**2607**	**METHOD NO.:**	**DX-S-01/Ver.4**
SAMPLE TYPE:	**Solid**	**INSTRUMENT:**	**GC-HRMS**
SAMPLE SIZE:	**10.0 g**	**CONCENTRATION IN:**	**pg/g**

Dioxins	Determined	Expected	% Recovery	Furans	Determined	Expected	% Recovery
T4CDD - Total				**T4CDF - Total**			
2,3,7,8	1.92	1.80	107	**2,3,7,8**	1.87	1.90	98.4
P5CDD - Total				**P5CDF - Total**			
1,2,3,7,8	5.72	5.00	114	**1,2,3,7,8**	5.56	4.60	121
				2,3,4,7,8	4.93	4.60	107
H6CDD - Total				**H6CDF - Total**			
1,2,3,4,7,8	5.33	5.40	98.7	**1,2,3,4,7,8**	5.62	4.60	122
1,2,3,6,7,8	5.06	5.00	101	**1,2,3,6,7,8**	5.62	4.60	122
1,2,3,7,8,9	5.00	5.20	96.2	**2,3,4,6,7,8**	4.82	4.60	105
				1,2,3,7,8,9	4.60	4.60	100
H7CDD - Total				**H7CDF - Total**			
1,2,3,4,6,7,8	4.92	4.60	107	**1,2,3,4,6,7,8**	5.07	4.60	110
				1,2,3,4,7,8,9	5.11	4.60	111
O8CDD	7.27	7.40	98.2	**O8CDF**	7.15	7.40	96.6

Labeled Compound	% Recovery
13C-T4CDF	69
13C-T4CDD	65
13C-P5CDF	67
13C-P5CDD	84
13C-H6CDF	72
13C-H6CDD	76
13C-H7CDF	66
13C-H7CDD	58
13C-O8CDD	69

1. Concentrations are recovery corrected.

Approved: _____
QA Chemist

ANALYSIS REPORT
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS

CLIENT SAMPLE I.D.:	**LAB BLANK**	**AXYS FILE:**	**WG5389-101**
CLIENT:	**Hatfield Consultants Ltd**	**DATE:**	**19-Jan-2002**
CLIENT NO.:	**2607**	**METHOD NO.:**	**DX-S-01/Ver.4**
SAMPLE TYPE:	**Blank**	**INSTRUMENT:**	**GC-HRMS**
SAMPLE SIZE:	**10.0 g**	**CONCENTRATION IN:**	**pg/g**
% Moisture:	**N/A**		

Dioxins	Concentration	SDL	Furans	Concentration	SDL
T4CDD - Total	ND	0.050	**T4CDF - Total**	ND	0.050
2,3,7,8	ND	0.050	**2,3,7,8**	ND	0.050
P5CDD - Total	ND	0.050	**P5CDF - Total**	ND	0.050
1,2,3,7,8	ND	0.050	**1,2,3,7,8**	ND	0.050
			2,3,4,7,8	ND	0.050
H6CDD - Total	ND	0.050	**H6CDF - Total**	ND	0.050
1,2,3,4,7,8	ND	0.050	**1,2,3,4,7,8**	ND	0.050
1,2,3,6,7,8	ND	0.050	**1,2,3,6,7,8**	ND	0.050
1,2,3,7,8,9	ND	0.050	**2,3,4,6,7,8**	ND	0.050
			1,2,3,7,8,9	ND	0.050
H7CDD - Total	0.050	0.050	**H7CDF - Total**	ND	0.050
1,2,3,4,6,7,8	0.050	0.050	**1,2,3,4,6,7,8**	ND	0.050
			1,2,3,4,7,8,9	ND	0.050
O8CDD	0.110	0.050	**O8CDF**	ND	0.050

Labeled Compound	% Recovery
13C-T4CDF	65
13C-T4CDD	64
13C-P5CDF	65
13C-P5CDD	89
13C-H6CDF	80
13C-H6CDD	83
13C-H7CDF	73
13C-H7CDD	64
13C-O8CDD	72

2,3,7,8 - TCDD TEQs (Using NATO I-TEFs)

2,3,7,8 - TCDD TEQs (ND=1/2 DL) =	0.072	pg/g
2,3,7,8 - TCDD TEQs (ND=0) =	0.001	pg/g

2,3,7,8 - TCDD TEQs (Using WHO 1998 TEFs)

2,3,7,8 - TCDD TEQs (ND=1/2 DL) =	0.085	pg/g
2,3,7,8 - TCDD TEQs (ND=0) =	0.001	pg/g

1. SDL = Sample Detection Limit
2. ND = Not detected
3. NDR = Peak detected but did not meet quantification criteria
4. Concentrations are recovery corrected.

Approved: _____
QA Chemist

ANALYSIS REPORT
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS

CLIENT SAMPLE I.D.:	**01 VN 950**	**AXYS FILE:**	**L4110-1**
CLIENT:	**Hatfield Consultants Ltd**	**DATE:**	**19-Jan-2002**
CLIENT NO.:	**2607**	**METHOD NO.:**	**DX-S-01/Ver.4**
SAMPLE TYPE:	**Solid**	**INSTRUMENT:**	**GC-HRMS**
SAMPLE SIZE:	**10.6 g (dry)**	**CONCENTRATION IN:**	**pg/g**
% Moisture:	**19.4**		

Dioxins	Concentration	SDL	Furans	Concentration	SDL
T4CDD - Total	9.11	0.050	**T4CDF - Total**	2.15	0.050
2,3,7,8	6.55	0.050	**2,3,7,8**	0.397	0.050
P5CDD - Total	5.49	0.050	**P5CDF - Total**	1.33	0.050
1,2,3,7,8	NDR(0.461)	0.050	**1,2,3,7,8**	NDR(0.08)	0.050
			2,3,4,7,8	ND	0.050
H6CDD - Total	9.59	0.050	**H6CDF - Total**	0.609	0.050
1,2,3,4,7,8	0.185	0.050	**1,2,3,4,7,8**	0.103	0.050
1,2,3,6,7,8	0.238	0.050	**1,2,3,6,7,8**	0.074	0.050
1,2,3,7,8,9	0.460	0.050	**2,3,4,6,7,8**	0.058	0.050
			1,2,3,7,8,9	NDR(0.238)	0.050
H7CDD - Total	6.08	0.050	**H7CDF - Total**	0.538	0.050
1,2,3,4,6,7,8	2.37	0.050	**1,2,3,4,6,7,8**	0.377	0.050
			1,2,3,4,7,8,9	ND	0.050
O8CDD	87.2	0.100	**O8CDF**	0.461	0.050

Labeled Compound	% Recovery
13C-T4CDF	75
13C-T4CDD	82
13C-P5CDF	69
13C-P5CDD	99
13C-H6CDF	76
13C-H6CDD	80
13C-H7CDF	70
13C-H7CDD	61
13C-O8CDD	72

2,3,7,8 - TCDD TEQs (Using NATO I-TEFs)

2,3,7,8 - TCDD TEQs (ND=1/2 DL) =	6.84	pg/g
2,3,7,8 - TCDD TEQs (ND=0) =	6.82	pg/g

2,3,7,8 - TCDD TEQs (Using WHO 1998 TEFs)

2,3,7,8 - TCDD TEQs (ND=1/2 DL) =	6.78	pg/g
2,3,7,8 - TCDD TEQs (ND=0) =	6.74	pg/g

1. SDL = Sample Detection Limit
2. ND = Not detected
3. NDR = Peak detected but did not meet quantification criteria
4. Concentrations are recovery corrected.

Approved: _____
QA Chemist

DX001B

ANALYSIS REPORT
POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS

CLIENT SAMPLE I.D.:	**01 VN 956**	**AXYS FILE:**	**L4110-4 I**
CLIENT:	**Hatfield Consultants Ltd.**	**DATE:**	**19-Jan-2002**
CLIENT NO.:	**2607**	**METHOD NO.:**	**DX-S-01/Ver.4**
SAMPLE TYPE:	**Solid**	**INSTRUMENT:**	**GC-HRMS**
SAMPLE SIZE:	**10.3 g (dry)**	**CONCENTRATION IN:**	**pg/g**
% Moisture:	**24.4**		

Dioxins	Concentration	SDL	Furans	Concentration	SDL
T4CDD - Total	3.72	0.050	**T4CDF - Total**	1.50	0.050
2,3,7,8	2.34	0.050	**2,3,7,8**	0.196	0.050
P5CDD - Total	0.591	0.050	**P5CDF - Total**	0.061	0.050
1,2,3,7,8	NDR(0.121)	0.050	**1,2,3,7,8**	0.061	0.050
			2,3,4,7,8	NDR(0.052)	0.050
H6CDD - Total	2.79	0.050	**H6CDF - Total**	0.883	0.050
1,2,3,4,7,8	0.130	0.050	**1,2,3,4,7,8**	0.169	0.050
1,2,3,6,7,8	0.212	0.050	**1,2,3,6,7,8**	NDR(0.095)	0.050
1,2,3,7,8,9	0.372	0.050	**2,3,4,6,7,8**	NDR(0.088)	0.050
			1,2,3,7,8,9	ND	0.050
H7CDD - Total	13.9	0.050	**H7CDF - Total**	1.32	0.050
1,2,3,4,6,7,8	5.62	0.050	**1,2,3,4,6,7,8**	0.644	0.050
			1,2,3,4,7,8,9	NDR(0.102)	0.050
O8CDD	622	0.120	**O8CDF**	1.09	0.050

Labeled Compound	% Recovery
13C-T4CDF	82
13C-T4CDD	75
13C-P5CDF	73
13C-P5CDD	72
13C-H6CDF	73
13C-H6CDD	79
13C-H7CDF	75
13C-H7CDD	70
13C-O8CDD	87

2,3,7,8 - TCDD TEQs (Using NATO I-TEFs)

2,3,7,8 - TCDD TEQs (ND=1/2 DL) =	3.17	pg/g
2,3,7,8 - TCDD TEQs (ND=0) =	3.14	pg/g

2,3,7,8 - TCDD TEQs (Using WHO 1998 TEFs)

2,3,7,8 - TCDD TEQs (ND=1/2 DL) =	2.62	pg/g
2,3,7,8 - TCDD TEQs (ND=0) =	2.57	pg/g

1. SDL = Sample Detection Limit
2. ND = Not detected
3. NDR = Peak detected but did not meet quantification criteria
4. Concentrations are recovery corrected.
5. TCDF concentrations reported from second injection.

Approved: _____
QA Chemist

Appendix A12

English Translation of the Sloping Agriculture Land Techniques (SALT) System and SALT Implementation Schedule for the Aluoi Valley Project

SLOPING AGRICULTURE LAND TECHNIQUES SYSTEM ALONG CONTOUR LINES AT DONG SON AND HONG THUONG COMMUNES, A LUOI DISTRICT

Every year, the situation of barren land, bald hills, gradually broken ecological environment and harsh climate changes are on the rise in sloping soil areas of A Luoi, Thua Thien Hue. Following are some causes:

- *The decrease of forests due to wars and toxic chemicals.*
- *The unreasonable cultivation in sloping areas, having paid little attention to erosion prevention, land and water preservation.*
- *The easy-going logging, nomadic and shifting cultivation and slash-and-burn practice.*

These causes have brought about the land erosion, poorly developed plants and low production of cultivated crops.

The cultivation in sloping soil areas, therefore, becomes an urgent task for local people in A Luoi District. This is expected to diversify products, increase income for farmers, soil improvement, land erosion prevention, slash-and-burn practice limitation, and ecological environment protection, particularly in areas affected by UXOs and toxic chemicals.

Here are some solutions to improve this situation:

- ***Applying some methods of erosion prevention, land and irrigation canal improvement, and green-manure plant growing along the contour line.***
- ***Reasonably arranging cultivation methods, the combined system of agriculture and forestry in accordance with the natural conditions of each region.***

SOME SPECIFIC PROCEDURES:

Step 1: How to identify and mark a contour line on the hill

(After clearing UXOs)

- Cutting down shrubs, vegetation, and clearing the hill to observe and mark.
- Carrying out works from the hilltop with the participation of two people (One person responsible for adjusting the A-letter ruler and the other will mark the contour's location).
- Making an A-letter ruler for first off identifying a contour. Fixing the end of the A-letter ruler from the beginning point to the touchline of the area

needs to be measured. Adjusting that end in such a way so that the plumb line coincides with the middle point of the crossbar. Therefore, the two points at both ends of the A-letter ruler are level (having the same height)

- Marking two previously mentioned points by a bamboo stake and continuing by moving the A-letter ruler. Placing one end of the stake to fix the end of the ruler and moving another end from top to bottom to define the third contour line.
- Doing the same task around the hill for identifying all contour lines.
- Defining the space among contour lines, according to the current topography (normally each of 4-6m). In case of Dong Son and Hong Thuong Communes, it is possible to choose the space between two contours of 5 m because the topography is not sloping.
- After fixing contour lines, some stakes is askew, in comparison with the common curved line of the contour. The reason of this phenomenon is that the surface of stakes is not equal. In order to readjust this awkwardness, simply arrange these stakes in a straight line with the curve of the contour line.

Step 2: To carry out methods of erosion prevention.

After identifying contour lines, farmers are able to carry out the following methods of erosion prevention, based on the current topography:

2.1 Digging drainage ditches along contour lines

- Drainage ditches are dug by hoes and shovels along identified contour lines, each of 50 cm high and 30 cm deep.
- Excavated land is normally used to fill up the bank under the irrigation system. Green-manure plants, pineapples will be grown on this bank to protect the drainage ditch, and preserve water and land.
- Drainage ditch digging is to protect land from erosion, reduce the stream flow and make rain water more absorbent in land and preserve the dampness for a long period of time.

Note: Building rock embankments in some places where thin soil and rock layers exists can be an effective solution for reducing the speed of water flow and erosion level. At the same time, stone gathering to pile up will help the cultivation more efficiently.

Stones are collected and piled up along the contour tracks with a width of 1m and a height of 0.5-1m. The elevation of the stone wall depends on the slope of the hillside and availability of material and labour.

2.2. Drainage ditches:

These ditches are dug 0.5m deep and 0.5-1m wide. It is necessary to dig across the hilltop and curve down on all directions of hillside to the hill base. They should to be connected with contour gullies.

Trees and grass can be grown along both sides of the ditches to slow current speed and maintain their form. In addition, erosion can be controlled by digging these ditches.

Step 3: Growing trees along the contour lines.

Growing tree barriers is the simplest solution of controlling the erosion. This tree wall will slow the speed of rain current and stop soil for gradually forming the natural steps.

Such trees as green-manure plants, grass, fruit trees, etc can form the tree wall.

These are perennial plants with quick development and nitrogen provided possibilities. Moreover, they can be used for making green fertilizer, food for cattle, wood and fruits. For pest limitation, it is possible to grow various kinds of trees in a row.

In order to grow green manure plants on the contour tracks; the track's width has to be 1 meter. In the case of growing along contour gullies, it is possible to sow on the lower earth-bank or on the gully surface of 0.5-1 meter wide.

Seeds will be directly sowed in prepared lines on the ground and then covered by a thin layer of earth 0.3-0.5 cm. They will be sowed into two rows with the seed quantity of 0.5-0.7 kg of seed for 100-m length in both rows, which is separated from each other about 40-50cm.

Sowing can be implemented together with making line to ensure the soil humidity and is usually done at the beginning of rainy season. Sowing season is from February to June or July and the best time for this is in February and March.

Pineapples are planted in two Z-shaped lines, one line and one tree is 30 centimeters apart from the other to keep the oil from being eroded down to the ditch.

The connection between fences living on contour lines together with pineapples or weeds will form an escalation system, which is able to last long. These kinds of plants positively affect the stability of soil and the growth of plant productivity.

Step 4: Identifying cultivation methods in the forestry-agriculture combined system

Depending on specific conditions concerning:
Land, terrain
Capital
Labour force

Each household may carry out proper cultivation methods. Normally, the following types are sufficient to agricultural mountainous areas:

* Hilltops are useful for long-term vegetation such as forestry plants, herbs, and fruit trees.

* Hillback parts, in between lines of green-manure plants, are efficient to food stuff plants, fruit trees, herbs, etc. Long-term plants are not ready to be reaped in some areas; short-term vegetation like cassava, pineapples, therefore needs to be simultaneously cultivated in the first few years.

* Hillback areas need to be arranged for fruit trees such as bananas, persimmon...

* The cultivating strategy " manipulating short term for supporting long term" can be carried out in places of which surface of hilly land outweighs that of fields. People cultivate agricultural short-term plants such as peanut, corn, green bean, and foodstuff trees for instant crops to guarantee living conditions of agricultural households. It is advisable to gradually replace short-term foodstuff trees planted on sloping land with fruit trees in lanes.

Step 5: Trimming and fortifying fences of green-manure plants:

The fences of green-manure plants belonging to the bean family may grow as high as 1 meter after 6-8 months. It is not necessary to trim fences of green-manure plants in the first season.

Those will need to be cut in the next season, leaving approximately 0.5-0.6 meter, and the cutting is done at the same time with the preparation for cultivation.

Trunks and branches of green-manure plants can be used as firewood or set up behind fences to reinforce the ability of anti-erosion.

Leaves and branches already cut will be scattered on the surface for annual plants or used as fertilizers for fruit trees. This is an important source of organic

fertilizer because it simultaneously prevents weeds and keeps the humidity of soil. In addition, trunks and leaves of green-manure plants make the soil scatter more evenly; this positively affects cultivation. Also, when disintegrated, this kind of tree will add a considerable amount of nitrogen, phosphate, etc into cultivation soil.

Fences of green-manure plants should be unceasingly protected; these can prevent erosion and the decadence of cultivation land, thanks to their probability of stabilizing nitrogen.

When breaking cultivation land for new crops, it is advisable to begin from higher parts, so as to make the lane flatter. Also, a distance of at least 20-50 centimeters needs to be kept between fences and seasonal plants.

Above are some simple remarks for the cultivation on sloping land areas. Farmers, however, are required to make full use of labour force to turn those into reality. It is important to notice that the protection of soil and water are the two main factors maintaining long-term cultivation. In conclusion, we should aim at a cultivation routine in which the fertility of soil and the protection of environment are highly considered.

THE IMPLEMENTATION PROGRESS OF A CULTIVATION PATTERN ON SLOPING AGRICULTURE LAND IN DONG SON AND HONG THUONG COMMUNES

(After clearing UXOs)

- **6-7/1/2002**

Moving from Hue to A Luoi to carry out a survey for selecting a cultivation pattern.

- **8-11/1/2002**

Designing a pattern and write instruction of sloping agriculture land techniques along contour lines for training farmers.

- **14/1/2002 (Morning)**

Moving from Hue to A Luoi to arrange work.

- **14/1/2002 (Afternoon)**

Discussing works with Hong Thuong Commune's local staff and drawing up a list of laborers taking part in the pattern implementation.

- **15/1/2002**

Morning: Organizing a workshop for the introduction of SALT pattern to farmers at Hong Thuong Commune's meeting hall.
Afternoon: Continuing with the workshop, training local people how to use the A-letter ruler and the marker ruler for defining contour lines on hills, setting up a plan with local people to distribute work.

- **16/1/2002**

Starting to build a contour irrigation canal and preparing land for sowing green-manure plants.

- **17/1/2002**

Carrying out the sowing of green-manure plant on contours.
Excavating arable land to sow groundnut and maize, initiating seeding.

- **18/1/2002**

Morning: Continuing with sowing seeds at Hong Thuong Commune
Afternoon: Moving to Dong Son Commune

- **19/1/2002**

Discussing work with Dong Son Commune's local staff, drawing up a list of laborers participating in the pattern implementation.

- **20/1/2002**

Morning: Organizing a workshop for the introduction of SALT pattern to farmers at Dong Son Commune's meeting hall.
Afternoon: Continuing with the workshop, training local people how to use the A-letter ruler and the marker ruler for defining contour lines on hills, setting up a plan with local people to distribute work.

- **21/1/2002**

Starting to build a contour irrigation canal and preparing land for sowing green-manure plants.

- **22/1/2002**

Carrying out the sowing of green-manure plants along contour lines
Excavating arable land to sow groundnut and maize, initiating seeding

- **23/1/2002**

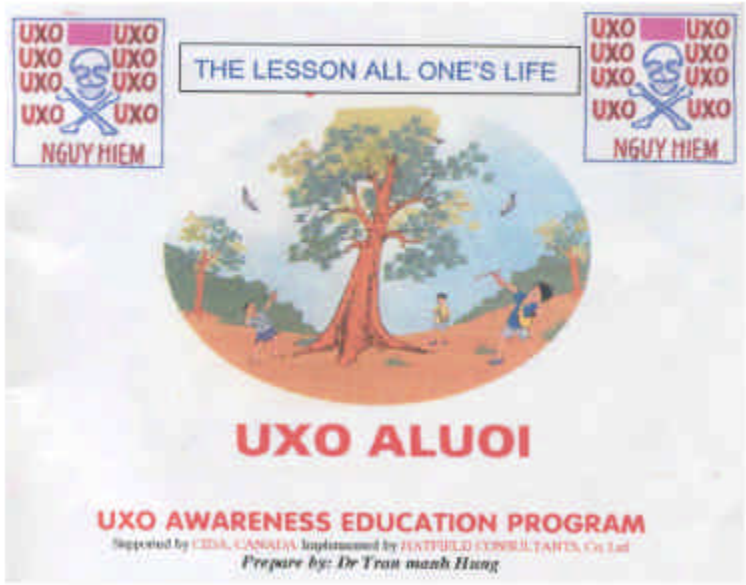
Observing and overseeing the pattern with A Luoi District and other related agencies.

- **During 24/1 and 30/5/2002**

Initiating care for plants of all kinds on the pattern.
Planting pineapple along contour lines
Repairing the irrigation canal along contour lines.

Appendix A13

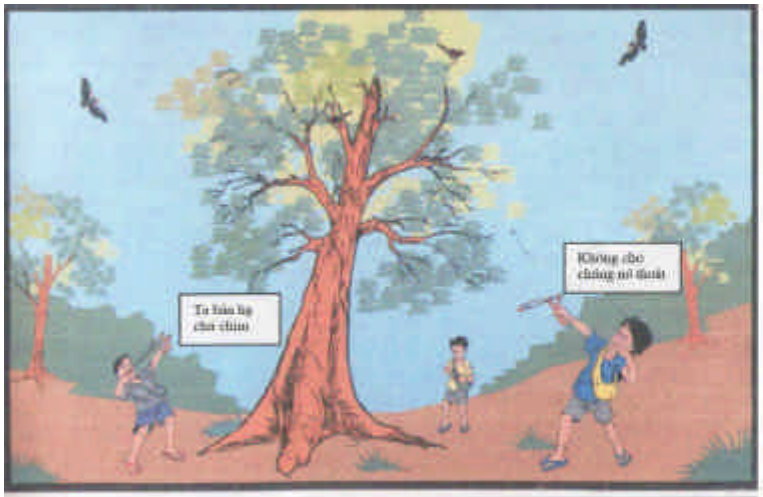
An Example of a Cartoon Picture Book Used to Educate Aluoi District Children of the Dangers of UXO



1- There are three close friends who live in A So Rok Village, are Yellow(Y), Blue(B) and Grey(G).

3. Once day, After finishing the class, G called for B and Y and went to forest to gathering fruits and shooting birds

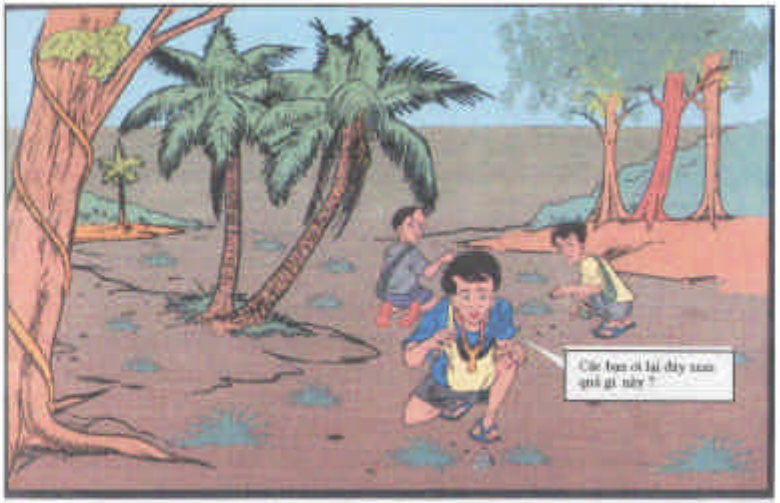
4. Without careful recommendations of parents and teachers, G eagerly lead to come to the prohibited forest where has a big TRAM tree (T).



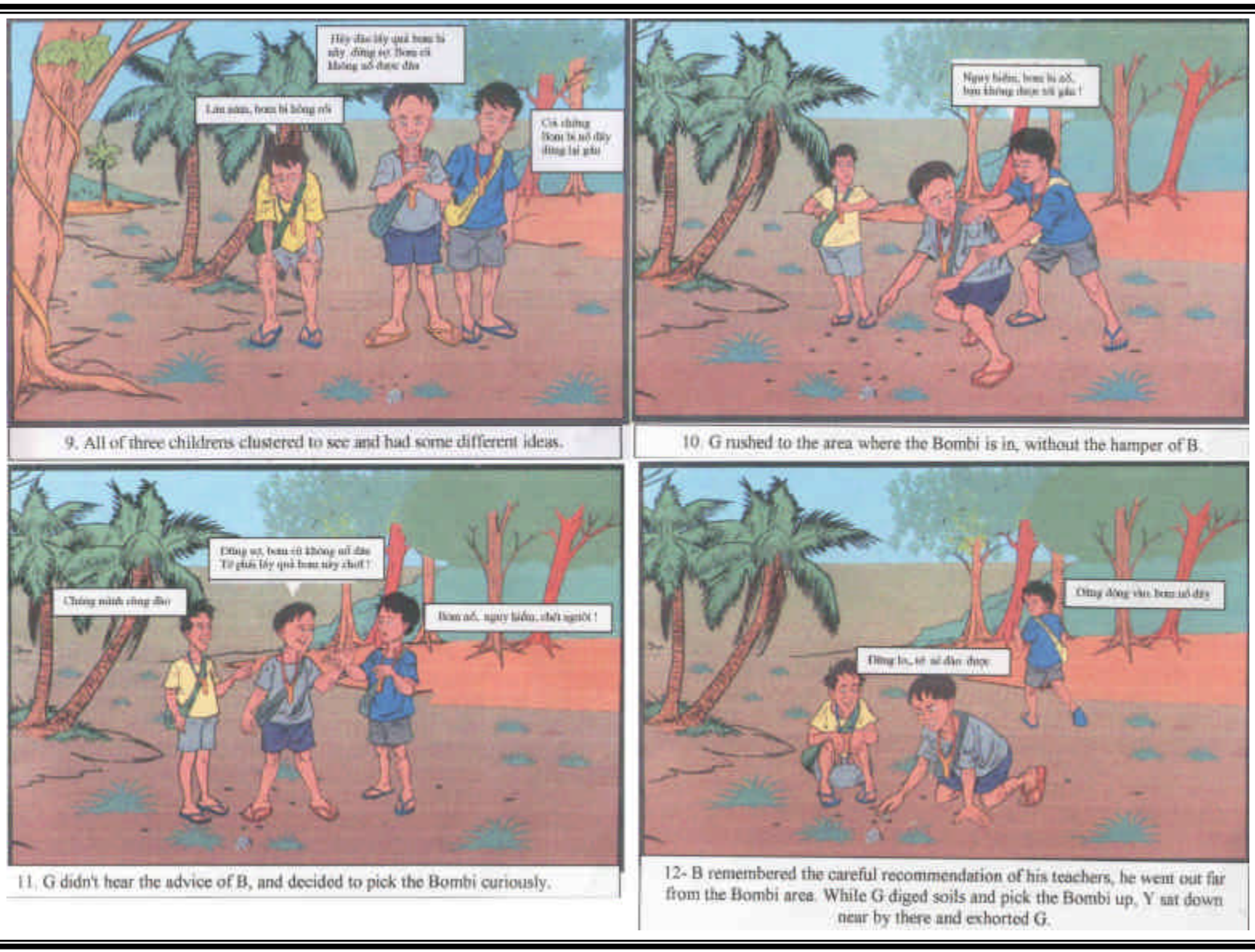
5. In the forest, three children were busy themself with gathering fruits and shooting birds, and no one noticed a dangered signboard set up near by there.

6. After one hour,no bird was shooted down, but there were many T fruits around foot of the tree. All of the children were satisfied with their shooting abilities.

7. G, Y and B were busy themself with collecting mature fruits around foot of the tree.



8. Suddenly, B saw a circle thing like a pincapple (infact that is a Bombi remained from the war).



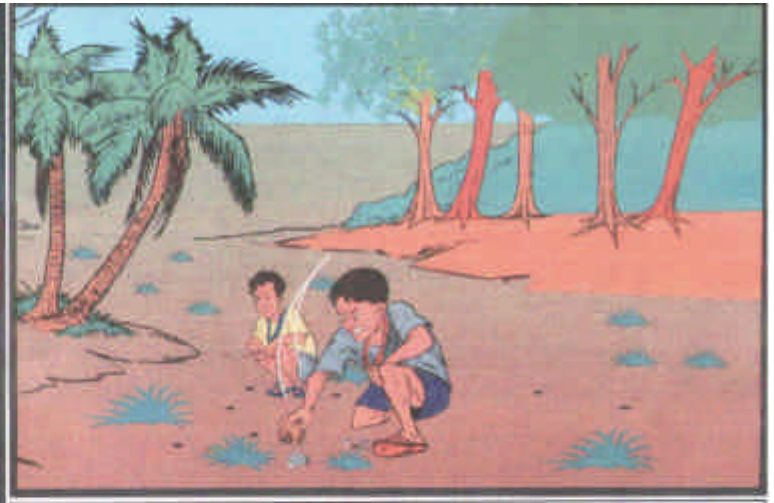
9. All of three childrens clustered to see and had some different ideas.

10. G rushed to the area where the Bombi is in, without the hamper of B.

11. G didn't hear the advice of B, and decided to pick the Bombi curiously.

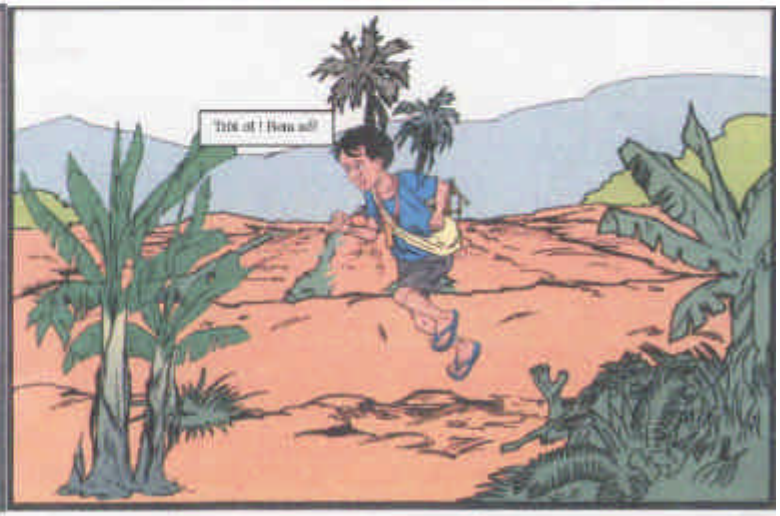
12- B remembered the careful recommendation of his teachers, he went out far from the Bombi area. While G diged soils and pick the Bombi up, Y sat down near by there and exhorted G.

13. Because the soil is very hard, G asked and got a stone from Y.

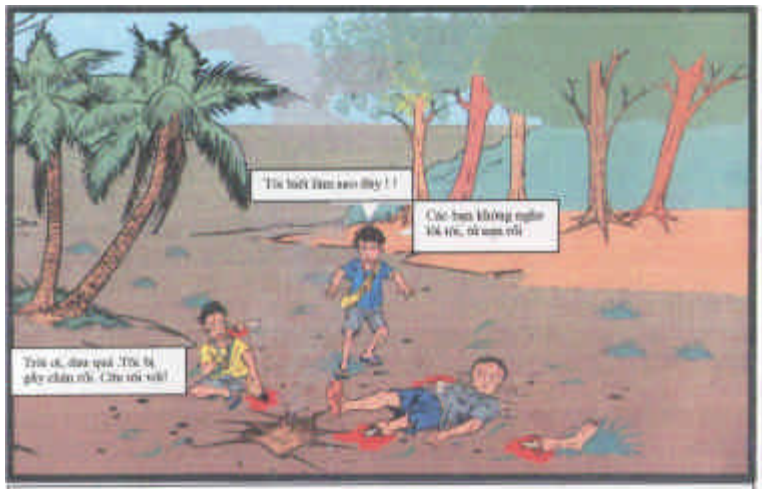


14. The Bombi was stricked strong blows by a stone held in G's hand

15. An exploded sound with a flash of shells lit up a whole area thowed soils, stones, G and Y up highly.



16. After startling with the big exploded sound, B rush to that area.



17. B did not believe in his eyes when he saw that G had been died on a blood pool with cutting one hand and one leg, and B was injured seriously.

18. B was hurry up to go back the village and to ask village's inhabitant helping G and Y. All village's people were worried following B to go to forest.

19. All people were stunned to collect dead bodies of G and to bring Y to the hospital. The G's parents were unconscious when they saw G being dead without a completed body.

20. because unbearing the careful recommendation of parents and teachers, now, G lost his life and Y has to walk with a paire of wood forks - It is really a lesson all one's life.