

Environmental and economic estimation of negative impact of waterproofing works and materials on environment and ability to live of the person

Evgeniy Velichko^{1,*}, *Edward Tshovrebov*² and *Vyacheslav Semenov*¹

¹ Moscow State University of Civil Engineering, Yaroslavskoye Chaussee, 26, Moscow, 129337, Russia

²FBU «The Research Centre on problems of management of savings of resources and a waste», Olympic prospectus, 42, Mytishchi, Moscow region, 142000, Russian Federation

Abstract. In article negative influence of waterproofing materials and works on health of people and environmental pollution is analyzed. Complex measures on maintenance of an ecological security, sanitary-and-hygienic requirements, size standards and rules both during works on a waterproof finish are resulted, and at the subsequent upkeep of buildings and premises, and also action for decrease in negative impact at carrying out of waterproofing works on a natural habitat condition, health of the workers occupied in repair-building manufacture and living. The estimation of components of the environmental and economic damage put to environment by manufacture of waterproofing works is given.

1 Introduction

Questions of protection of a natural habitat and health of citizens both in the course of realization repair and civil work, and at the further exploitation of premises, buildings, structures are functionally connected with level of ecological and sanitary-and-hygienic safety of applied building production at all stages of its reversion.

At carrying out of the waterproofing works providing protection of land and underground building designs (pipelines, the bases, basements and so forth) from impact of water and liquid excited environments, a number of ecologically unsafe materials on the basis of polymers, bitumen imbibition's and the tars, environment causing a significant damage and to health of people is applied. By production of such works the significant amount of the waste demanding processing in the secondary production or salvaging is formed. All these ecologically hazardous processes have negative impact on a condition of environment, natural resources and health of citizens.

* Corresponding author: pct44@yandex.ru

2 Problem statement

Till now in regions of Russian Federation the problem of assembly, processing of a hazardous waste of waterproofing works properly is not solved: bitumen, bitumen mastics, epoxy mastics and other sorts of mastics, the packaging materials, the ground polluted by bitumen, the remnants of the rolled isolation, the fulfilled slag, the asbestos chip, polymeric products, forming an essential ecological problem as a whole for branch [15, 16].

Analyzing an actual problem as a whole, it is necessary to notice, that a complex estimation of influence of various types of a waterproof finish on a condition of natural objects, questions of materials recovery of insulation works, estimations of the damage put by them to environment in modern scientific researches to the full it is not considered [17-32].

Considering absence of such researches in the domestic and foreign literature, and also the urgency and the importance of an existing problem for ecological security maintenance at carrying out repair and civil work, in article are stated results of scientific researches on formation of a complex estimation of negative impact of waterproofing works and materials on environment, health of people with an estimation of a put ecological, economic damage.

3 Results and discussion

Waterproofing products from the point of view of negative impact on health of people and a circumambient are expedient for sizing up in a slit as modular condition: liquid (the impregnating, jet, priming, film-forming); put compacted (plastic insulating concrete and solutions); is plastic-viscous (coating mastics and doughs); glued (on mastics and colloidal solutions); the finishing; elastic-viscous and solid (film, the roll, sheet, bulk), and on sorts of applied materials for various types of isolation: bulk, jet, the impregnating, from sheets, mastics and paints, solutions and hydrophobic powders, metal and polymeric sheets.

With a view of pressure seal of junctures and joints of precast iron concrete designs in modern construction use plastic (bituminous, is bituminous-polymeric, etc. mastics on the basis of bitumen), flexible (the roll strips, tapes, sheets), elastic (profile rubber materials), isolation with single-component (on the basis of polyurethane foam) or the two-component (is bituminous-polymeric) joint sealants, the combined waterproof finish.

With a view of isolation of underground designs, except them, can follow-up be applied is bituminous-latex, it is bituminous-emulsion types and a bitumen felt, and at isolation of surface constructions of a building – all sorts epoxy, bituminous, concrete, cement, glued, the roll waterproof finish [4, 6, 7, 9, 10].

Ecologically hazardous waterproofing coatings from polymer cement and polymeric concrete are introduced. Presence in their composition, in the capacity of furan, polyester and phenolic formaldehyde resins result to allocation in a free air of toxic organic compounds: phenol, methanol, formaldehyde, ammonia, a phthalic anhydride, ethylen glycol, diethylene glycol, styrene and ethyl benzene. In events of application improving properties of concrete of additives (for example, polyvinyl acetate) air medium fouls spikes of acetone, ethyl acetate, benzol, dibutyl phthalate, dioctylphthalate, vinyl acetate, acetic aldehyde. Excess daily average and a work area of maximum concentration limit of these hazardous contaminants in air medium can call negative aftereffects for a human body, in particular: vinyl acetate - irritation mucous or a burn of a cornea of eyes; acetic aldehyde - irritation of mucous membranes, an inflammation and a hypostasis of lungs; acetone - the biological accumulation, leading to chronic poisoning, intoxication [1, 2, 8].

Various sorts of bituminous roll materials in the capacity of applied now izol glass, an izol foil is necessary to evolve a bitumen felt, roofing felt, izol, hydro izol, hydro. As a part

of each meant material there are certain sorts of bitumen's and the bitumastic's which are a source of negative impact on ingredients of a circumambient.

For imbibition of elements of designs of buildings (the bases, slabs, pipes, girders) with a view of maintenance of rust resistance, water tightness, frost resistance of designs in the capacity of the impregnating hydraulic insulating material (Standard of Russian Federation «Mastic the is bituminous-rubber insulating») is used hot, liquid, or heavy asphalt in the form of hot imbibition, and also bitumen emulsions (the maintenance of bitumen more than 50 %) with application of emulsifying agents (1-3 %) and inoculating additives: latex, rubber, polymers. At manufacturing of such hydraulic insulating materials integumentary, impregnating bitumens are applied; for other purposes (mastic, dough) - bitumens of type BN. In the capacity of disperse filling materials for mastics materials of various extent of toxicity are used: a cement kiln dust, ground slag, ash, fibrous fillers - the disintegrated glass-fibre, a mineral wool, asbestos. Roofing and waterproofing mastics (bituminous, is bituminous-polymeric, is bituminous-rubber, etc.) Within the limits of Standart of Russian 30693-2000 «Mastics roofing and waterproofing» make, as a rule, on the site in the open air, mixing in batch agitators bituminous dough, an emulsion with disperse or fibrous filler to the consistencies defined by standards [3, 4].

At the analysis of hazardous impact of oil asphalt with filling materials, it is necessary to take into consideration physical and chemical composition of the oil building bitumen consisting from hazardous to a circumambient and health of people methanoic, naften, aromatic hydrocarbons with an extraneous matter of joints of oxygen, nitrogen, sulphur.

Grading of harmful production factors at works on a warming up of oil asphalts and bitumastics is introduced on Fig. 1. These ecologically hazardous factors simultaneously are a source of negative impact on natural habitat ingredients (a free air, soil, vegetative and fauna, aqueous installations).

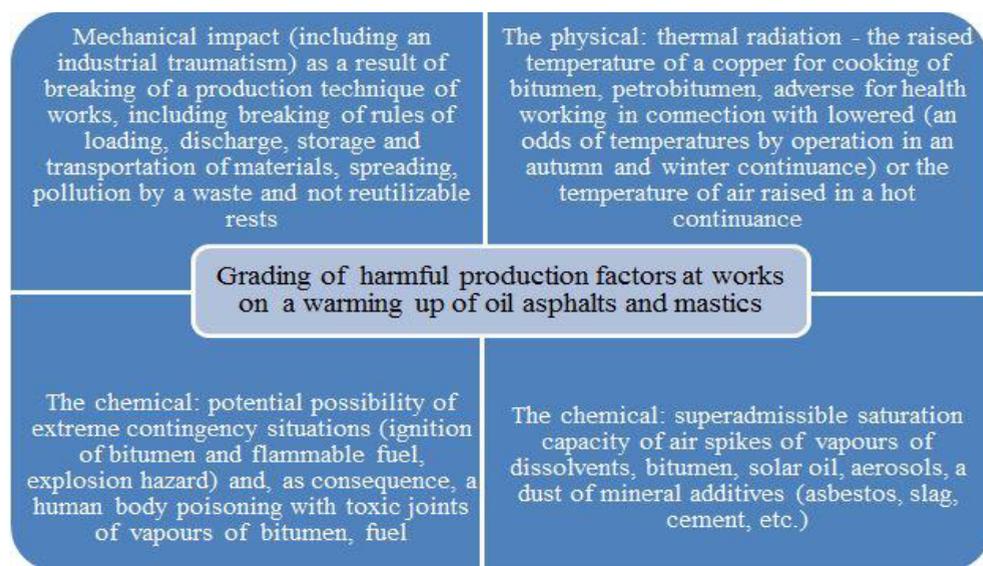


Fig. 1. Grading of harmful production factors at works on a warming up of oil asphalts and mastics.

Bituminous hydraulic insulating materials are capable to evolve a number of toxic joints, thus intensity in an aerosphere and contamination hazard of air sharply increases at their warming up. Bitumen and a road tar can call dermatitises, hyperplasias of a false skin and a leather, a papilloma. Pairs melted bitumen possess irritating act on a leather, mucosas of eyes and the upper respiratory tracts. Pairs mineral hydrocarbon oil introduce health

hazard of the person, calling changes in arterial pressure and making negative impact on the central nervous system at breaking of admissible size standards [1, 2].

In places of production of such works the supervisory control of observance of maximum concentration limit daily average and a work area on the toxic joints formed at a warming up of bitumen, fuel burning in the equipments of fusion of bitumen and burners is obligatory: to white spirit, kerosene, alcohol, white damps, nitrogen, to sulphur dioxide; preparation of bituminously-butyl rubber mastic: to benzine fuel (slate), to xylene, toluene; is bituminous-latex mastic: to phenolium, a dust containing asbestos. It is bound to hazardous impact of toxic substances on health of the person. Mineral fillers (finely dispersed cindery, lime-dolomitic), organic solvents have negative impact on breath organs, sight, integuments, a gastroenteric section [1, 2, 8].

With a view of maintenance of an ecological security of work on a bitumen warming up are made on expressly taken away platforms at operating crew minimisation, on a safe passing distance from places of an agglomeration of people on the site or behind its limits (provided that concentration of vapours of contaminants in these working areas does not exceed admissible size standards), in strict observance of sanitary-and-hygienic demands of environment protection and health of the person. Places of a warming up of mastics and the bitumens, placed on expressly taken away platforms, range on distance: from buildings and structures IV-V of extent of flame-resistance - not less than on 30m; III item-20 of m; I and II item-10 of m [11, 12]. Working with bitumens and bitumastics in accordance with Standard of Russian Federation 12.3.040-86 "Works roofing and waterproofing» are provided with individual defence agents: filtrateing breathing masks, suits, shoe, mittens and a goggles.

Among other liquid insulants ecological hazard introduce: epoxy oil, epoxy-furan of mastic, an emulsion on the basis of styrene, phenolium, a formic aldehyde, epoxy, furfurool, urea-formaldehyde resins, oil (a tar asphalt solution in toluene) and perchlorovinyl lacquer from synthetic resins on toxic dissolvents - benzene chloride, butyl acetic aether, xylene, solvent. Except high-toxic styrene, phenolium, a formic aldehyde, such materials contain other ecologically hazardous joints: ethanol, butanol, ammonia, furfurool and benzene chloride. Other joints which are a part of epoxy resins are not less toxic also: diphenyl propane, ethylene diamine, diethanol amide, toxic anhydride, epichlorohydrin, diamine. Having property in due course to collect in an organism and possessing irritating act, at inhalation, they can lead to a strong boring of mucosas of eyes and the upper respiratory tracts, and at hit in inside organism - to promote origination of a bronchitis, dermatitis's, a derangement of organs of digestion, breaking of nervous system [1, 2, 8].

Health hazard of the person sharply increases in need of drawing of viscous, fast-drying or badly shaded compositions of various waterproofing products by ways of air-operated and hydrodynamic spraying. For prevention of hit of vapours of toxic joints in respiratory system of the person, on integuments and mucosas, by production of waterproofing works presence of agents of an individual defense is obligatory.

Analyzing level of negative impact of hydraulic insulating materials on a circumambient and health of the person it is possible to note, that the basic ecological and hygienic safety materials from a sheet waterproof finish are the zinc-coated and aluminium sheets. In certain extent are harmless applied in the capacity of film materials has flown down a product cloth, the charging waterproof finish which is carried out by placement by beds on the compacted ground or a concrete bed in submersible hollowness's with casing use in case in the capacity of sealers hydrophobic powders from sand or few toxic materials are used: asphalt izol, hydrophobic ash, perlite.

Recently toxic bituminous and oil insulants are in large quantities substituted less hazardous organic polymeric (silicon-organic, methyl acrylate, organic silicone) by emulsions, coating products on the basis of organic compounds: polyurethane, rubber-like,

polymers of a type of butyl rubbers (mastic hydrobutyl), with a little toxic filling materials (a chalk, comminuted rubber) [5, 13].

Largely ecologically safety hydraulic insulating material of the class-room of the water-soluble silicates is the water glass in the form of solutions of silicates of sodium and a potassium in water. It is widely applied with a view of a waterproof finish of water resisting, heat-resisting and acid-proof concrete to various designs of walls, floors, floorings, basements, wells, the device of water areas. Acceleration of a dripping of concrete from formation of sodium aluminate and the depressed permeability of a pore space additives for watertight concrete reception have caused wide application of a water glass in the capacity of at carrying out of emergency operations - termination of leakages, junctures and a waterproof finish. The product is a pollution-free antiseptic agent, interfering with a mould growth, decay, fungi [14].

By results of the made analysis of the yielded problem it is possible to note, that, as a whole, negative impact of waterproofing works on a natural habitat, displayed in the form of migration of hazardous making hydraulic insulating materials in a free air, surface and underwaters, soil, depends, first, on a sort of an applied material, presence and the maintenance in it of toxic substances, secondly, from climatic, hydrological and other conditions of a working area of construction (temperature, activity of solar rays, chemical aggressiveness of ingredients of a natural habitat, their background dirtiness the various joints actively entering chemical reactions with formation of toxic substances) and, thirdly, from a site of the hydroisolated design of a construction (land, underground or subsea, depth of a contour interval, presence of contact with soil, subsoil waters, etc.).

Potentially possible environmental and economic injury put to a natural habitat as a result of production of waterproofing works *Unatural habitat* (roubles) will be summed up from following components:

$$U_{nh} = U_{water} + U_{air} + U_{land} + U_{soil} + U_{vegetation} + U_{bioresources} + U_{trouble} \quad (1)$$

U water – the injury put to surface and underground water sources as a result of a translocation and migration of pollutants from a surface of hydraulic insulating materials in an aqueous medium;

U air – the injury put to air medium as a result of technological pollutant emissions and (or) burning of a toxic waste;

U land – the injury put to land resources as a result of mechanical impact, and also migration, carryover of pollutants from a surface of hydraulic insulating materials in land and underground beds;

U soil – the injury put to fertile bed of land – to a soil mantle as a result of technological pollution by chemicals, placement of a hazwaste of production and consumption;

U vegetation – injury to flora as a result of impact of pollutant emissions (e.g., a bitumen warming up), and also mechanical impact (a junk pile, a translocation of toxic extraneous matters and so forth);

U bioresources – the injury put to fauna and aqueous biological resources as a result of technological physical, mechanical, biological or chemical action of waterproofing works;

U trouble – the injury put to all ingredients of a natural habitat as a result of the emergency battery waste interceptions, spikes of hazardous substances, explosive and fire-dangerous situations with negative ecological effects.

In the capacity of the basic costs on compensation of deficits to a natural habitat expenses for recultivation of lands, potable water clearing, elimination of junk piles, restoration of trees, liquidation of aftereffects of extreme contingency situations (bitumen straits and so forth) are observed. Economic losses can be attributed to the irreversible loss of insulation products during the ablation of bulk materials in connection with violations of the conditions of storage, transportation, loading and unloading, process marriage, leading to the formation of significant quantities of construction waste.

4 Conclusions

Authors of article investigate scientific approaches on formation of a complex estimation of negative impact of waterproofing works and materials on environment, health of citizens with an estimation of a put ecological-economic damage to natural objects and resources, factors and sources of such impact are defined. Taking into account stated and urgencies of the yielded problem within the limits of scientific researches by authors of article will be developed scientific both methodological approaches and criteria of an ecological security of waterproofing materials on which basis it will be scientifically formed and practically proved optimum complex of nature protection actions at carrying out of civil work.

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