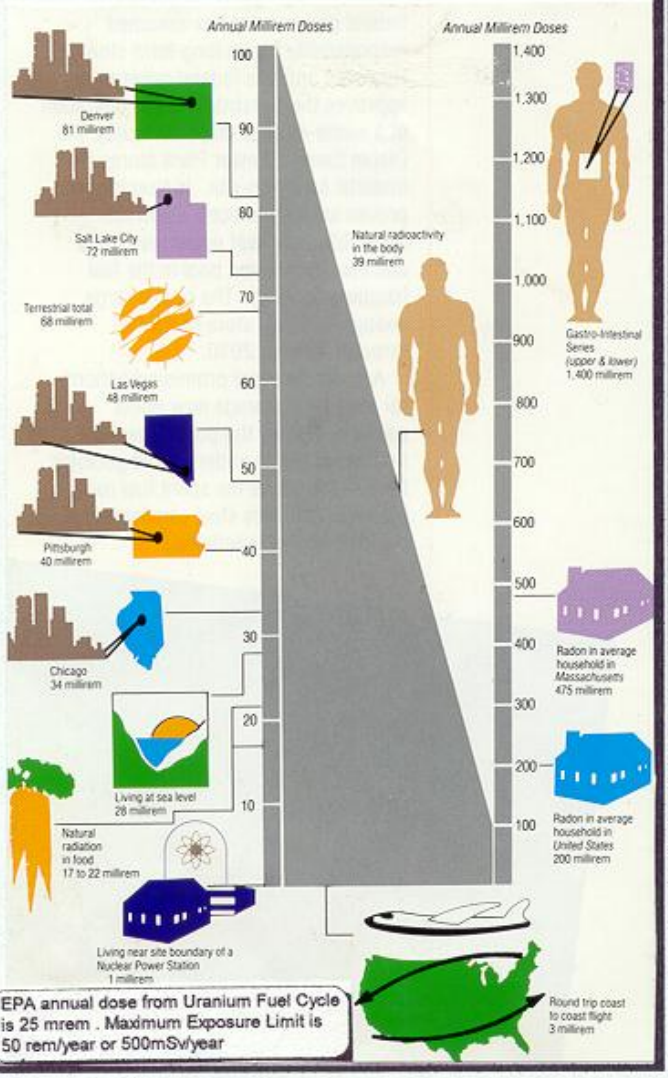
KALMATRON® KF-αβγ

The inorganic powdered compound of KF-αβγ with oscillator's structure applicable as a coating on any structure by plaster technology and admixture into cement materials against radiation and liquid permeability.

RADIATION SOURCES



EPA annual dose from Uranium Fuel Cycle is 25 mrem . Maximum Exposure Limit is 50 rem/year or 500mSv/year

■ USES of KF-αβγ:

Application is available by coating, admixture and injections of concrete, masonry and reinforced concrete of nuclear plants, storage of nuclear wastes, isolation of civil buildings, roads, tunnels, bridges and injections into mines, sinkholes, tunnels, pipes, tubes, etc.

■ TECHNICAL FEATURES

- Gray powder without any odor.
- After mixing with water as 3 :1 becomes like plastic dough with wet density of 3,500 Kg/m^3.
- Any paint is applicable on the surface of KF-αβγ layer. At 4 to 6 hours after application it works also as a water-proofer. Works as a radioactive protection immediately after application.
- The Durability of KF-αβγ layer depends on the thickness of applied coating.

■ PREPARATION OF KF-αβγ

1. Take a batch of the chosen consumption of KF-αβγ per square unit of protected surface.
2. Add 1 part of water into 3 parts of KF-αβγ by volumes and mix it for 1 minute.

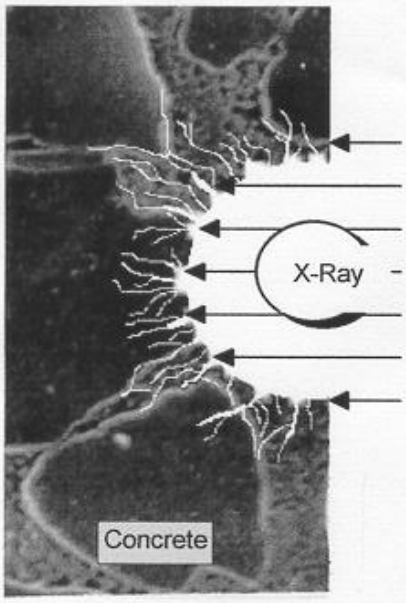
■ TECHNICAL DATA of KF-αβγ

- Setting time..... 15 min to 30 min
- Hardening time..... 35 to 50 min.
- Slump..... 5 cm (2")
- Shrinkage..... 0.0075%
- Compressive strength: TIME.....Kg/cm^2
  28 days..... 350
  Rupture: 28 days.....75
- Liquid Impermeability..... 100%

■ BENEFITS

- No special preparation of surface before application. Just wet by water.
- No sanitary limitation for application and farther for users.
- Acceptable for humid and wet conditions on air and on a surface of application.
- KF-αβγ is the most workable and cheapest technology for enhancing of Radioactive Resistance
- Isolation of structures and environmental infrastructure as an admixture and injections.
- Deactivation of civil and fortification infrastructures by plaster technology without training of staff.
- Highest variability of the methods of applications.
- The level of protection is comparable with lead, which is also known as non applicable.
- KF-αβγ the only product the non-toxic, non explosive and non flammable for this field of structural protection.

KALMATRON® KF-αβγ



Penetration of X-rays through especially metallizated concrete surface from the source point of radiation is given by metallographical method. Ionized field of concrete's crossection is visible as white spots and sparks.

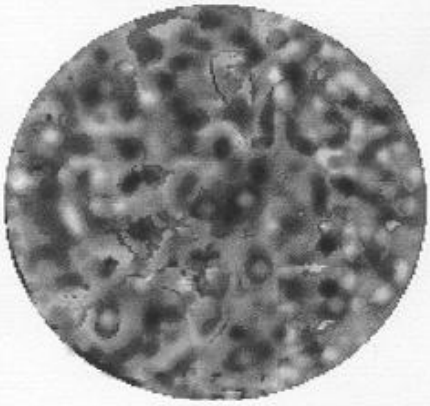
Concrete is an unpredictable material for radioactive protection because the aging of the structure every year make it crumble. It faces a decrease in original density and weakening of natural resistance to X-rays. It's well known today that radiation destroys concrete, just like the periodical heating and cooling processes.

The theory of protection from radiation was developed by two main directions to enhance of MRR (Material' Radioactive Resistance).

The first one is an increasing of natural density by any known heavy fillers. Most of them are poisons and technically are not applicable on most civil and fortification structures.
The second direction is based on a high resistance of free fluctuations to γ-particles by dissipation of energy. These so-called dissipative systems are very popular in modern technology

Specially formulated chemical compound of KF-αβγ hardens after mixing with water with a process of new growth of crystals. These crystals are singular singonies and are very similar to ice crystals, but with a series of free structural gratings, which works for the dissipation of γ-particles' striking energy.

That is why even powder of KF-αβγ, which is very crumbly, has a high MRR, which is amazingly distinctive from the common understanding of radioactive protection.



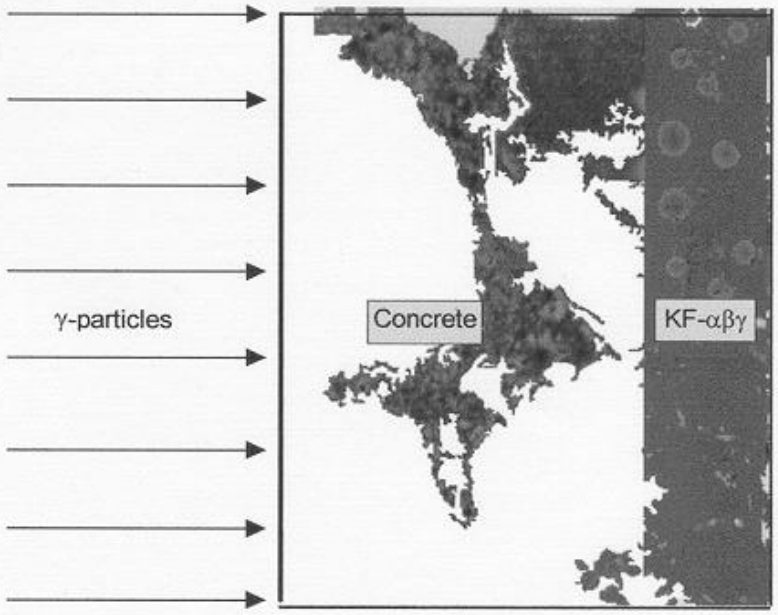
Metallographical fragment of KF-αβγ image of layer with stagnated γ- particles as a white spots and sparks.

METALLOGRAPHICAL IMAGE OF SPECIMEN

Source of γ radiation is exposed from the back side of protected concrete.

Ionized fields of metallizated concrete and KF-αβγ layer are recognizable by uncolored spots.

Concrete is visible for X -rays on the whole depth of structure.
Steam of γ-particles is stagnated by KF-αβγ layer just on the border between concrete and KF-αβγ.



PROTECTION OF POWER PLANT BY KF-αβγ

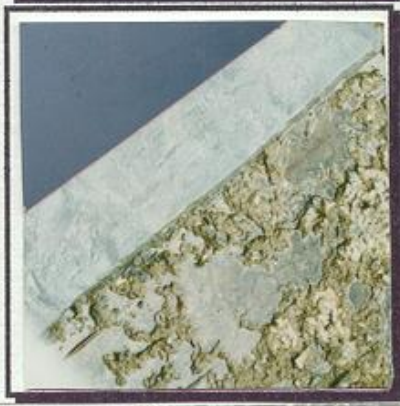
Typical deterioration of concrete and masonry structures of water cooling facilities by radioactively contaminated water.

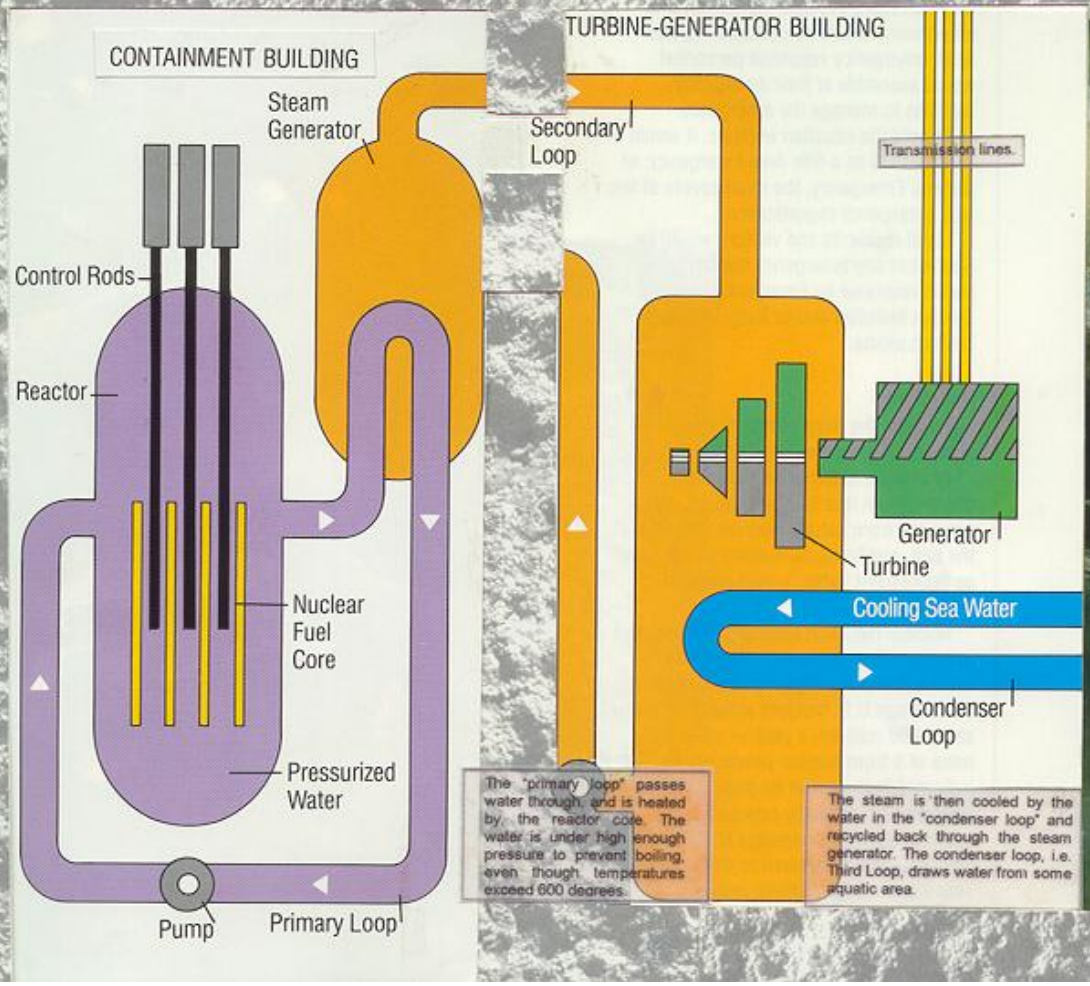
The reason of water contamination is not established. In accordance with project (see below), all of the three cooling Loops are separated.

The preliminary probe of KF-αβγ by patching is completely isolated annual 1,576,800mrem or 1.8mSv/h till 0.25 mSv/h.

Repair is done selectively by coating of extremely contaminated concrete and masonry structures by KF-αβγ 25mm layer with final oil painting.

The superficial compressive strength is 350 Kg/cm^2.





KALMATRON® KF-αβγ

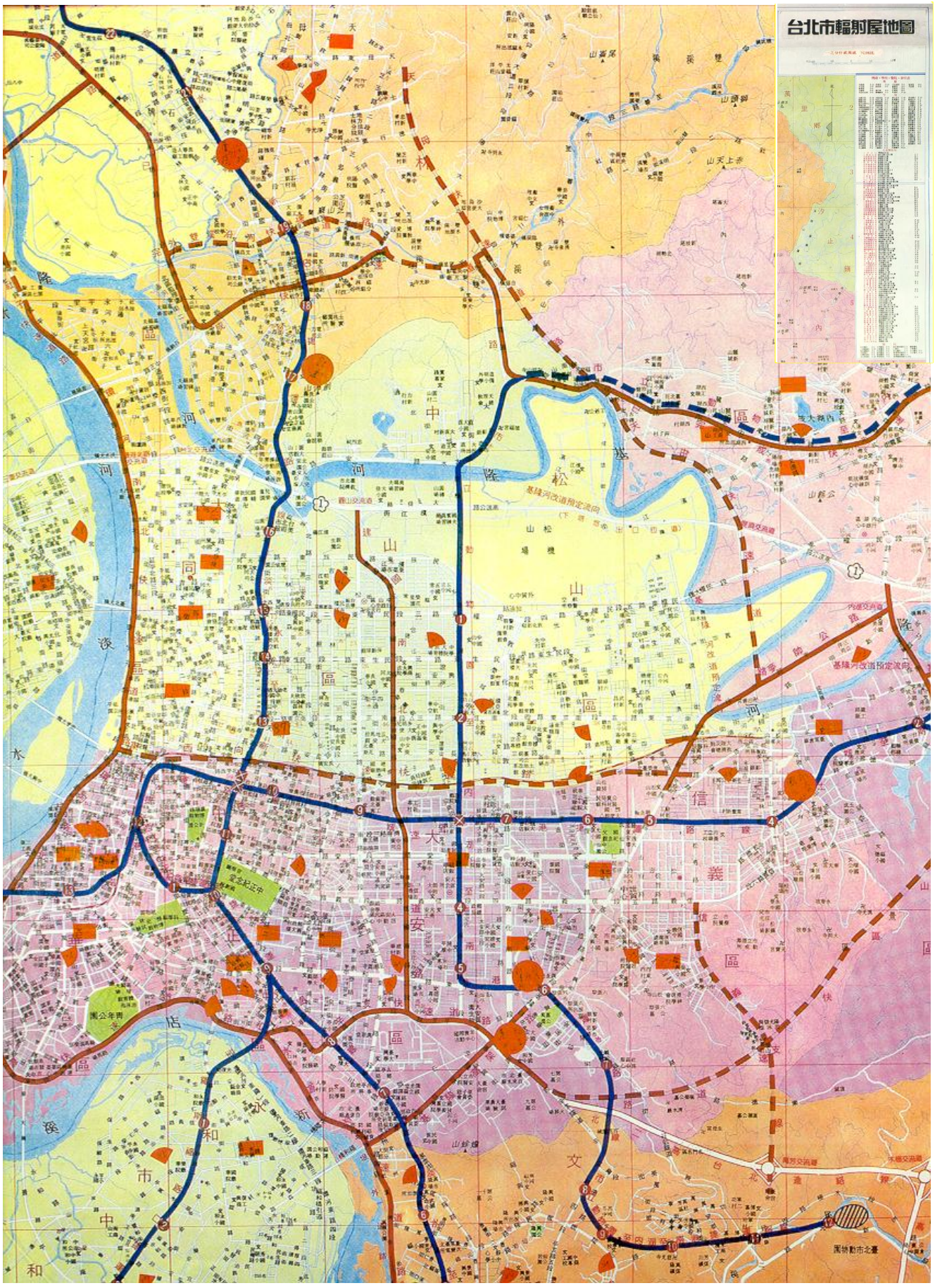
The rebar is the source of radiation of Co 60. This is the strong γ-ray emitter with Z = 27, $T_{1/2}$ = 5.3 years, E_γ = 1.17 ÷ 1.33 MeV.

"This is just too big a tragedy for the Government to face up to. No one can handle it, so as a result the best strategy is just to cover it up". YANG Chao-Yueh, Professor at National Taiwan University. "China News, 05//31/98"

Highly contaminated apartment is empty, and is not supposed to be sold.
By KF-αβγ it might be returned to the normal conditions.

Contaminated building in Taipei, Taiwan is still dangerous for tenants.
By KF-αβγ layer it might be reduced at 4.4 to 0.35 μSv/h.

The map of Taipei City with radioactively contaminated civil and public buildings shown by red spots. The source of radiation is rebar made from Co 60.



Water cooling pool at the end of the Third Loop of the Nuclear Plant with pressurized water reaction system.

Concrete is severely deteriorated and lost targeted resistance to radiation. The preliminary probe of KF-$\alpha\beta\gamma$ by patching is completely isolated annual 1,576,800 mrem or 1.8 mSv/hour till 0.25 mSv/hour.

Protected concrete by KF-$\alpha\beta\gamma$ layer. The surfaces for coatings were selected by the most extreme readings.

The final surface of KF-$\alpha\beta\gamma$ layer is painted in accordance with specific regulations.

The superficial compresiive strength is 350 Kg/cm^2.

Unestablished source of radiation behind off-shore wall. The structure is prepared for coating by KF-$\alpha\beta\gamma$ after numerous probes and readings.

KALMATRON® KF-αβγ

LANDFILL OF RADIOACTIVE WASTE

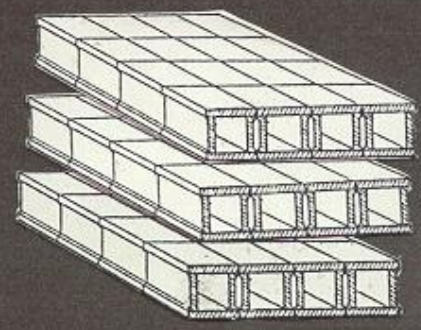
STANDARD DISPOSAL

Disposal may be designated in authorized areas on land or in the ocean after processing for volume reduction by compression or incineration. Materials for disposal into the ocean are packaged in 55 Gallon concrete encased drums and transported to designated areas about 150 miles at sea in about 7,500 feet of water. Abandoned salt mines are being seriously considered as a repository for solid wastes containing radioactive materials.

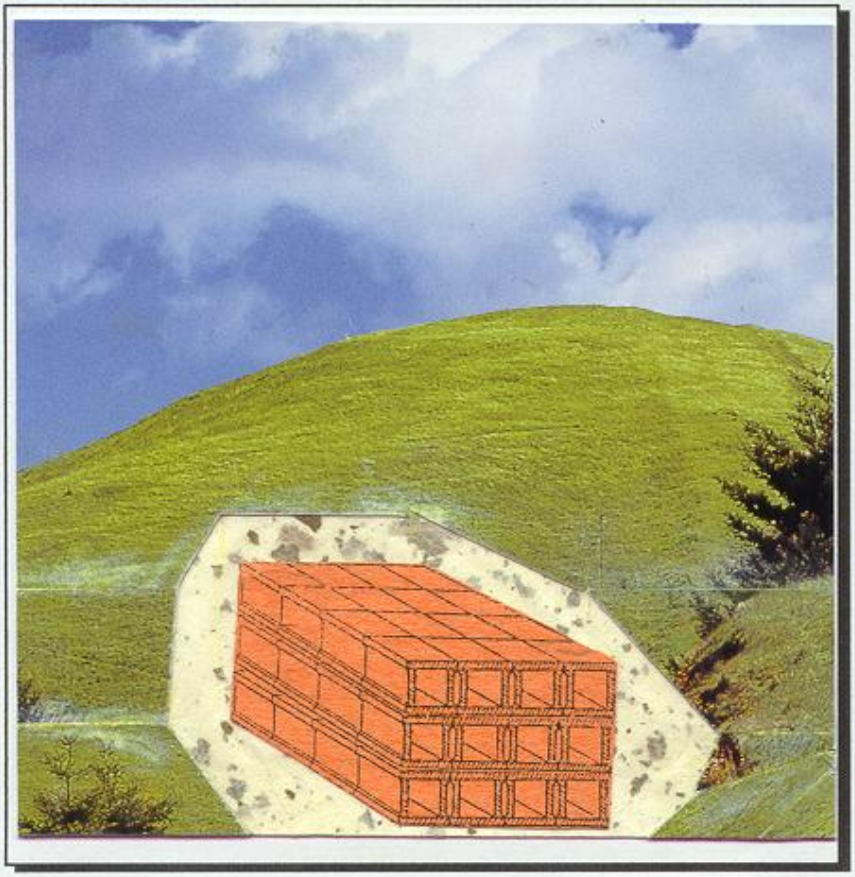
DISATVANTAGE: This type of disposal is not approachable for control and repair.

KALMATRON® KF-αβγ

- KF-αβγ is a light gray powder. After mixing with water, it provides protection from penetration of radiation and liquid permeability. Applicable by both stucco and additive technologies.
- KF-αβγ has an excellent possibility for casting containers for dumping radioactive wastes. It might be standard container or pouring the KF-αβγ mix into unshaped mines and excavations.
- The significance of KF-αβγ is the simplicity of application and durability for rock-life years in normal conditions. Combination of KF-αβγ and KF-B application allows to dump radioactive wastes on underwater conditions.
- KF-αβγ is non-toxic, non-flammable and not explosive powder. Safety of operations with KF-αβγ is similar to cement mixing jobs.



Dry Cast Containers from KF-αβγ



LANDFILL OF RADIOACTIVE WASTE

This is the safest and most economical type of landfill of nuclear wastes even in industrial areas. Due to the ability of KF-αβγ to isolate environment from radiation, we can get inexpensive dumping in shallow excavations for nuclear wastes under or in the foundations of structures.

ADVANTAGES

- No export of nuclear waste. Independent feasibility of the most safe dumping technology.
- No necessity to change the standard con - tainers. Fill it out with KF-αβγ.
- No obstacles with further development of infrastructure on the land of a nuclear dump.
- Approachable for control and repair.
- Applicable for drawn territories and both derelict and fertile lands.
- Feasible application for the casting of foundations and anchors by mixing the concrete mix with KF-αβγ admixture and compacted debris of nuclear waste.
- KF-αβγ is a non-hazardous product, which is harmless during application and in the further contact with environment and civilian infrastructures.

KALMATRON®

°BLOCK KFαβγ

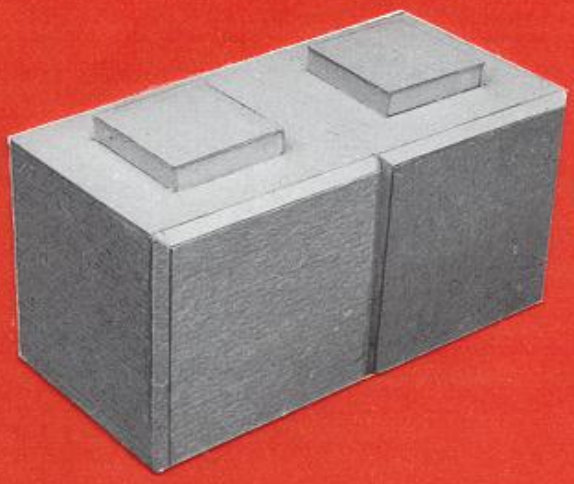
RADIOACTIVE WASTES

The radioactive wastes are represented in all operations of nuclear energy and military industries and facilities, including such items as contaminated paper, laboratory glassware and equipment, as well as end products, such as chemical slurries and sludges, evaporation solids, ion exchange resins, concrete, rods of reactor, etc. Concern over the control of radioactive wastes is world wide. Moreover, containers for disposal should be under control after geostresses, explosions and pollutions, because of the durability of these containers is predictable for the ordinary natural conditions. The safest structure for nuclear waste should be approachable for control and repair.

PROPOSAL: Is use the concrete masonry units °BLOCK KF-αβγ with the highest resolutions of resistance to radiation, deformations, heat transfer resistance and liquid permeability.

°BLOCK KF-αβγ

- °BLOCK KF-αβγ is a concrete masonry unit with admixture of KF-αβγ mixed with certain quantity of standard concrete mix. The structure from these blocks provides protection from penetration of radiation and liquid permeability. Montage of blocks provided by the masonry technologies.
- °BLOCK KF-αβγ has an excellent possibility for building of fortification structures and storages for radioactive wastes. It might be both of underground or over ground structures and buildings with highest resistance to radiation and radioactively contaminated liquids.
- The significance of °BLOCK KF-αβγ is the simplicity of application and durability for rock-life years in sever climate and urban conditions. Every block has especially shaped dent, which size targeted to specific climate conditions for highest heat & cool transfer resistance.
- Installation provides by joining the thorns of lower block with dents of upper blocks on KF-B mortar by standard technology. This installation provides the air-closed spaces into masonry structure, impermeability between seams and immovability of the whole structure.



°BLOCK KF-αβγ

- TECHNICAL DATA:

Dimensions:	20cmx20cmx40cm
Compressive strength:	500 Kg/cm^2
Tensile strength	45 Kg/cm^2
Freeze-Thaw Resistance:	> 500 cycles
Impermeability on 40 ATM:	100%
Resistance to γ Radiation:	100%

Heat Resistance is provided at -22°C to +45°C
Installation is approved by KF-B mortar.

- °BLOCK KF-αβγ is non-toxic, non-flammable and not explosive concrete masonry units.

Warehouse from °BLOCK KF-αβγ for storage of control rods, laboratory and industrial equipment, contaminated by radiation.

KALMATRON® KF-αβγ

WELLFILL OF RADIOACTIVE WASTE

STANDARD DISPOSAL

Abandoned mines are the most suitable for repository of radioactive solid wastes. Compressed or incinerated wastes are packaged in 55 Gallon concrete or metal encased drums and gated into the main.

DISATVANTAGE: This type of disposal requires expensive transportation, guarded territory and is not approachable for repair.

WELLFILL BY KALMATRON® KF-αβγ

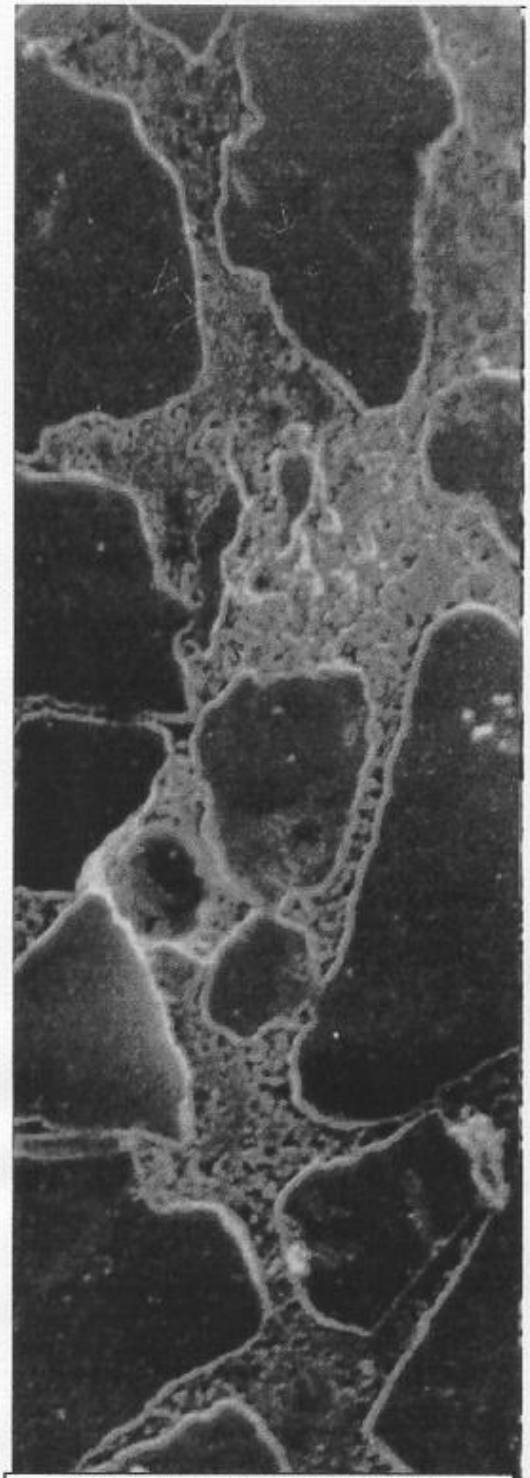
- KF-αβγ is a light gray powder. After mixing with standard concrete mix, it provides the best material for pouring of draw-wells with targeted protection from penetration of radiation and liquid.

A boneyard of uranium - contaminated scrap.

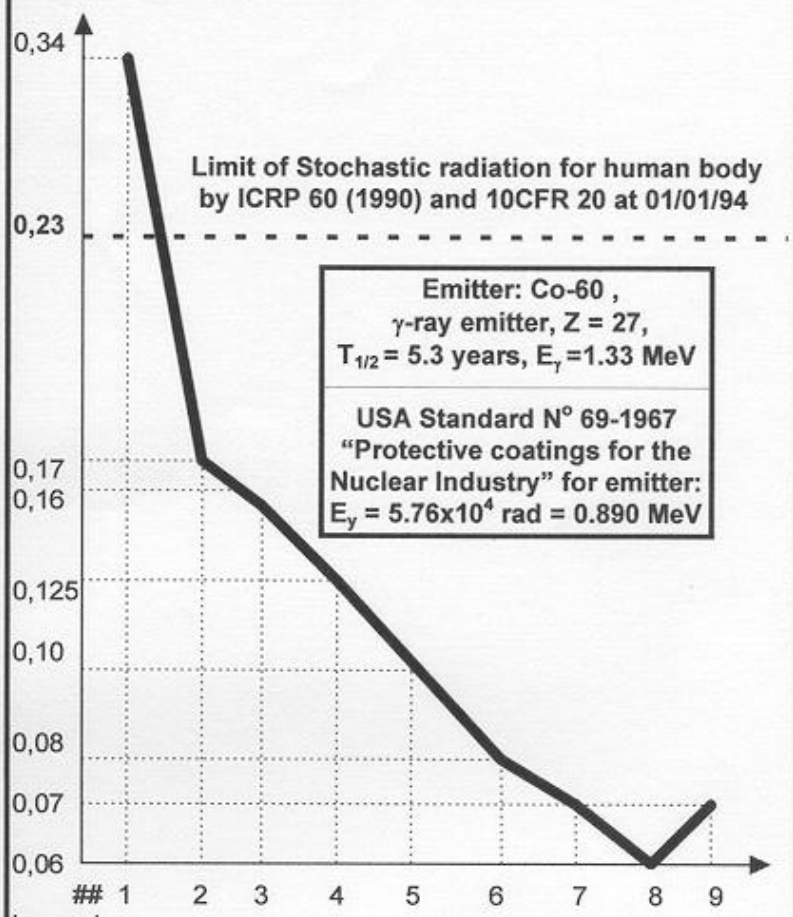
Removing of depleted uranium products.

Mixer for mixing of Compressed or Incinerated wastes with KALMATRON® KF-αβγ

Walls and bottom of concrete draw-well from mix of CONCRETE+KALMATRON® KF-αβγ for repository of radioactive wastes. Due to the ability of KF-αβγ to isolate the environment from radiation and liquid permeability, this type of dumping is inexpensive by excavation of a number of 50FT depth mines near and in industrial areas.



Resistance of KF-αβγ to γ- radiation in comparison with Concrete & Lead



Legend:

#1. Shielding by 30 mm of concrete slab,
#2. The same protected by 10mm of KF-αβγ layer,
#3. The same protected by 15mm of KF-αβγ layer,
#4. The same protected by 20mm of KF-αβγ layer,
#5. The same protected by 30mm of KF-αβγ layer,
#6. The same protected by 45mm of KF-αβγ layer,
#7. The same protected by 55mm of KF-αβγ layer,
#8. The same protected by 65mm of KF-αβγ layer,
9. Shielding by 30mm of lead slab.

LIMITS OF RADIATION FOR HUMAN BODY

STOCHASTIC RADIATION

Maximum exposure limit during of 24 hr::

$20x10^3$ [μSv /yr]:365[days]=54.80[μSv /dy].
20 [mSv/yr] : 365[days] = 0.0548[mSv/dy]
$2x10^3$ [mrem/yr]:365dy = 5.48[mrem/dy]

The maximum exposure limit during of 1 h:

54.80[μSv /dy] : 24[hr] = 2.3[μSv/hr]
0.0548 [mSv/dy] : 24 [hr] =0.0023[mSv/hr]
5.48[mrem/dy] : 24[hr] =0.23 [mrem/hr]

NONSTOCHASTIC RADIATION

Maximum exposure limit during of 24hr.:

$500x10^3$[μSv /yr]:365[dy]=1,370.0[μSv /dy].
500 [mSv/yr] :365 [dy] = 1.370 [mSv/dy].
$50x10^3$ [mrem/yr]:365 [dy]= 137.0[mrem/yr]

The maximum exposure limit during of 1 h:

1,370.0 [μSv /dy] : 24[hr] = 57 [μSv /hr]
1.370 [mSv/dy] : 24 [hrs = 0.057 [mSv/hr]
137.0[mrem/dy] : 24 [hr]= 5.7[mrem/hr]

UNITS OF MEASUREMENTS RADIOACTIVITY

DOZE OF IONIZING RADIATION OR EXPOSURE DOZE:

Activity of a radionuclide, exposure of radiation cure **Ci**, roentgen **R**
$1MeV = 1.602 \times 10^{-13} J$;
$1J = [m^2 Kg/s^2] = 10^7$ ergs = 0.2388 calorie = $624x10^7$ MeV;
$1J = 1:1.602 \times 10^{-13}$ MeV= 6.24×10^{10} MeV = $624x10^7$ MeV ;

ABSORBED DOSE

Absorbed dose in becquerel -**Bq**, gray -**Gy**, sievert -**Sv**; coulomb-**C**, and **rem** - roentgen equivalent men and **rd** or **rad** radiation absorbed dose.
$R = 2.58 \times 10^{-4}$ C Kg^{-1} = 88 ergs / g = 0.88 rad = 8.8 mGy;
$R = 10^{-2}$ J Kg^{-1} ;
$Ci = 3.7x10^{10}$ Bq; (1gr of radium 226) ;
1 Bq = $1s^{-1}$;
1Gy = 1 J Kg^{-1} = 100rad ;
1rad = 100 erg/g = 10^{-2} Gy;
1rem = 10^{-2} Sv ;
1Sv = Q x 1Gy = Q x J Kg^{-1} = Q x 624 x 10^7 MeV/Kg ;
100rem = 1Sv/h = QxGy = QJKg^{-1} = [m^2 Kg/s^2 x1/kg] = [m^2/s^2] = Qx0.624x10^{19} KeV/Kg.