must be mentioned in sediment process. HF polymers are seen greatly in vapor phase and the chemical reaction produces the following materials:

Vapor: H_2O , $(HF)_8$, $(HF)_6$, $(HF)_2$, HF , UF6 $HF.H_2O$, and dry air

Solid: UO_2F_2, UF6

When UF_6 penetrate out, it can be stated that all hexafluoride uranium changes to FH and UO_2F_2.

$$UF_{6(g)} + 2H_2O_{(g)} \rightarrow UO_2F_{2(s)} + 4HF_{(g)}$$

$$2(HF) = (HF)_{2(g)}$$

$$6(HF) = (HF)_{6(g)}$$

$$8(HF) = (HF)_{8(g)}$$

$$HF_{(g)} + H_2O_{(g)} = (HF.H_2O)_{(g)}$$

Free HF compounds themselves have toxic effects and the maximum permitted level for 8h/day inhalation is 0.1 ppm, because exposing more than 8 h make a great volume of this materials to find way to livers and damage its cells (about 22 liter/min air). If UF_6 permeation is in room temperature and presence of air humidity in that temperature, reaction includes hydrated UO_2F_2 and mass $HF\text{-}H_2O$ that are seen as white cloud. The reaction with extra water is summarized as following:

$$UF_{6(g)} + (2+4x)H_2O_{(v)} \Rightarrow$$
$$UO_2F_{2(s)} * 2H_2O + 4HF * xH_2O_{(fog)}$$
$$+ heat$$

If humidity is low, the white cloud isn't made and solid UO_2F_2 particles are made. UO_2F_2 has solubility in water; the yellow solid whose color exactly depends on its size and hydration degree. The produced heat in the first reaction is 288.4 kj/kg from UF_6 gas and the produced heat in reaction with extra water is 2459 kJ/kg of UF_6 vapor if UO_2F_2 is hydrated and $HF\text{-}H_2O$ cloud is made.

CONTAMINATOR EMISSION IN PRESENCE OF VARIOUS CONSTRUCTION MATERIALS

Contaminators emission can be influenced by various obstacles in air stream or reactive materials path. Therefore, various states happen in these conditions that each one can significantly influence on materials distribution in environment. Hence, first various emission conditions on building are examined without considering other climate conditions of the region or sophisticated events that are mentioned in the following: (Perkins, 1974).

Effects of buildings and obstacles on ground

UF_6 emission occurs near building and may be influenced by the effect of various obstacles in path. These obstacles change emission streams and deviate boundary layer. Therefore, dilution, emission, and distribution of UF_6 will change. The influencing factors to notice the effect of these obstacles are as following;

- Buildings may be high and their distance is short, so this condition traps UF_6 between walls.
- UF_6 emission maybe from tanks, pipes, other other installations inside building and penetrate to out through side air among windows or chimneys and roof of the building.
- Emission from a short chimney can guide UF_6 toward ground and near buildings, so its concentration will increase in region.

It is obvious by what was stated that the effect of building and obstacles on ground in emission path can have significant effect on stream pattern and change its concentration. Answering to the following questions will teach us to use which formulas and regulations to get contaminator concentration in various conditions and distances (Danvers, 1995)

- Where is the resource of contaminator?

Is this resource in wind counter direction toward building or not?

Is this resource in on building?

Is this resource in wind direction toward building or not?

- Where is the contamination receiver system?

Is it on building surface?

Is it near or back of building?

Is it near building in wind direction?

- How much error is made by predicted changes of contaminators concentrations for presence of building obstacles?
- Which level of buildings sophisticated are the formulas incorrect, and how near are the conditions and assumptions to the reality?
- Is there efficient data to be used in essential formulas?

Three samples of emission positions are studied individually in this research as following;

1- Trapping and emitting contaminator mass among building and the related effects.
2- Emitting contaminator on building or through chimney
3- Emitting contaminator mass form chimney and it stream to downward.

EXAMINING CONTAMINATORS EMISSION IN DIFFERENT CLIMATES

When contaminators penetrate around systems in nuclear plants, they mix with the surrounding air fast and will distribute in gaseous form in space.

One condition that can significantly influence on amount and type of each contaminator or even on sediment and removal of contaminators from surrounding space is raining. Raining and snowing wash contaminators including UF_6 (by reaction with them), increase the HF concentration on ground, and prevent from its emission by air. The contamination mass includes mixture of gases, solid, and suspended particles in air. Other smaller particles react with materials and obstacles on the ground in stream path and will be removed from atmosphere by plant coverage.

Removing pollutants by gravity and sediment process

The sediment rate by gravity will be about 10 cm/s for the bigger emitted particles such as UF_6 in air whose diameter is bigger than 50μm. In this case, removing toxic materials will happen by gravity.
Except big particles of UF_6, other products of hydrolysis reaction such as UO_2F_2 have small diameter about 1μm. Other materials like UF_6 or gaseous HF, and also $HF.H_2O$ won't be evaluable by gravity. The $HF.H_2O$ compound is considered gaseous and will be evaluated by dry sediment formulas. The discussed particles and gases can be separated from the emitted mass and then precipitated by rain, snow, fog, or cloud by two methods:

- In fog and cloud: by small particles of fog and clouds
- Under the cloud: by precipitation though descending drops of snow or rain on ground among a contamination mass.

RADIOACTIVE MATERIALS EMISSION BY EXPLOSION

The most concerns about radioactive materials are after explosion in an extensive area. In such cases, more volume of radioactive materials can exposed people to mortality level. The most popular scenario of attacking to uranium enrichment plant or feed or plant products containing vehicles. The great emitting resources such as initial feeds and the enriched uranium products won't have easy transportation, and constructing proper protection is not simple. However, chemical reactions with the present water vapor in air occur quickly and contaminators distribute in extensive area for being floating in air by a missile attack or bombardment of tanks, environmental degradation, and releasing UF_6 in environment; in this case, special filters and proper ventilation can't prevent from emitting materials to environment in plant space.

Emission the resulted contaminations by explosion depends on explosive strength, adhesion and weather conditions, portability of radioactive particles by air particles, and explosive materials. Each emitted gas emit radioactive materials besides HF, but finally sediment on materials and grounds surfaces as mental particles and makes environmental contamination. The most probable case in this state is just small areas in region are contaminated, but chemical contaminations must be scrutinized not to distribute by water flows and wind blowing in other areas.

Radioactive gases, liquid, and suspended particles are internal and external radiation resources. Distance reduces dangers and irritation exposure. Areas with high risk can be explosive to several kilometers. An explosion with lower amount of radioactive materials can contaminate great area as big as city or small area as big as several kilometers.

EMISSION THE MAIN MATERIAL OF URANIUM ENRICHMENT PLANT (UF6) BY FIRING

It is assumed that cylinder with UF_6 is damaged by fire accidents and consequently UF_6 of these tanks will be emitted to environment. The assumption of this study is the presence of tanks with excavated UF_6. It means the output of centrifuge which was poor of U_{235} isotope and is the working basis of non-suspended distribution model (Monte Carlo Lagrange diffusion model). Accidents and events leading to UF_6 emission and hydrolysis reaction of products will be in one fire accident that are divided to three total classes:

First class: during which the cylinder is in the fire, finally the tank pressure increases by high heat of fire and UF_6 evaporation in cylinder, so it damages and emit of UF_6.

Second class: during which cylinder is broken and UF_6 goes into fire.

Third class: in includes accidents happening after extinguishing the fire and the cooling stage.

Each occurred situation has its actions to reduce contamination and specific formulas to examine contaminator concentration. The obtained concentration in this part is based on time function above ground level in favorite internals. The UF_6 concentration in studies and also hydrolysis products such as HF and UO_2F_2 has been obtained in two different climates:

1) Stable D condition with wind speed about 4m/s
2) Stable f condition with wind speed about 1m/s

The determined concentration in this field will be maximum that an individual can receive in his/her position. This issue is so important for individual health and hygiene.

Description the excavated UF_6 emission in fire accidents

When UF_6 containing cylinders are transported from one location to another in inside or outside of plant many be floated in fire in one of firing probabilities events. This accident my happen in vehicle that work with gasoline fuel. Therefore, the related fire is also provided by this fuel. In this condition, fire heat increases the tank inside temperature, so sublimation, and emission of UF_6 to surrounding. This sublimation can break walls and emit hot UF_6 to environment by increasing tank internal pressure, and its hydrolysis with water happens quickly. The continuity of firing will guide amount of UF_6 to above fire and being hydrolyzed quickly. Finally, UF_6 emission will continue to 30 min after fire exhaustion or its suffocation. Flotation reduces and emission stops after increasing mass density.

In addition, it is assumed that UF_6 react immediately after going out of tank, and produces hydrolysis products such as HF and UO_2F_2 with 1 μm diameter. Therefore, this part just evaluates concentrations of these two materials. UO_2F_2 for high molecular weight can have very low rate and precipitate on ground, but HF is gaseous and non-precipitated, but can be absorbed by plant coverage. (Role of plant coverage is evaluated in this article). However, physical and chemical properties and conditions are two important issues that must be considered.

Two general regulations are determined in next studies for the resulted dangers by emitting toxic products of UF_6. First class is accidents with irreversible potential effects, and another class is harmful potential effects. The threshold of harmful potential dangers for UO_2F_2 is 10 mg and for HF is determined 1 h.

Flotation effects of spring

Two equations classes are used to consider mass flotation condition in resulted accidents by fire: one id for fires and another is for moment heats. In order to obtain the proper formulas to determine hydrolysis products concentrations of UF_6, dominant boundary conditions on problems must first be identified. It is also assumed that when mass is raised from ground level by buoyancy force, it won't be settled on it again, actually it won't go to the lower boundary layer.

Uf_6 mass emission

There are three classifications for each condition of UF_6 transmission in text:
- State based on non-floatation of mass.
-state such as fire smoke
- State of heat floating

Table 4 shows 5 evaluated accidents in this article. These accidents include three types of initial accidents with 2 sub-set encompassing all existed cylinders in UF_6 emission [5].

Table 4. Description of 5 evaluated accidents in fire

Accident	Description	Chemical form	LB value	Time (min)	Emission surface
Fire of vehicles, three tanks filled with UF6 and an 48G	Three filled tanks with UF6 will be damaged by firing for fuel combustion or other combustible materials in vehicles hydraulically	UF6	0 11500 8930 3580	0-12 12 12-30 30-121	ground
Fire of vehicles, three tanks filled with UF6 and an 48Y	Three filled tanks with UF6 will be damaged by firing for fuel combustion or other combustible materials in vehicles hydraulically	UF6	0 18000 2770 8010	0-24 24 24-30 30-236	ground
Fire caused by small aircraft collided, two tank filled with UF6 and an 48G	1 UF6 full tank is damaged by airplane collide. Another tank is hydraulically damaged by fire resulted from airplane fuel.	UF6	0 3840 2980 1190 4240 1190	0-12 12 12-30 30-121 0-30 30-121	ground
Fire caused by small aircraft collided, two tank filled with UF6 and an 48Y	1 UF6 full tank is damaged by airplane collide. Another tank is hydraulically damaged by fire resulted from airplane fuel	UF6	0 6020 920 2670 3210 2730	0-24 24 24-30 30-236 0-30 30-236	ground
Firing the vehicle, 2 waste tanks	Vehicle had an accident and two waste tanks are damaged or the fuel of vehicle made UF6 combustion and emission.	UF6	39 10	30 30	ground

The first method is when tank is full of UF_6 has been immersed in whirlwind of flames. Vehicle my lose its control in this accident and diesel fuel in vehicle tank is poured out and makes fire for 30 min. it must be mentioned that vehicle tank capacity and type make difference in size and time of firing. It is assumed for more examinations that the three tanks full of UF_6 are excavated in vehicle.
If tank is not broken by this collide, firing will eventually breaks it. As soon as breaking, UF_6 emits out of tank and mixes with surrounding air. This makes a little floatation. Since three involving cylinders in firing will not be damaged simultaneously, UF_6 emission will happen permanently and gradually for each cylinder. In addition, it is assumed that there must be at least 30 min interval for tank break. 48Y and 48G tanks were studied in this article.
The second method in this text is collide of a small airplane with tank full of UF_6. It is assumed in this accident that collide breaks the first cylinder in the first moment and the second cylinder will be damaged in fire. Description the elements of accidents are similar to the first accident. In this case, just two sets are considered, one is two 48G cylinder, and another is two 48Y cylinder.
Third method doesn’t have sub-set and irradiation from waste cylinders is mentioned. Accidents by both airplane collide or firing, include hydraulic damage or cooling stage. These tanks are small and have a little UF_6 amounts. It is assumed that all UF_6 will be emitted by firing in 30 min.

In this part, 48G and also 48Y cylinders with 14 ton capacity were studied that were excavated from UF_6 which were floated in fire of 1475°F for 30 min. two emission types were considered for 48G and 48Y cylinders. [2, 6]

Tank was put in fire without being damaged. In this accident, 48Y and 48G cylinders will be damaged in 24 and 12 min, respectively after being floated in fire. However, cylinder damage is by increasing its internal pressure; UF_6 is poured out of tank suddenly in this time. After tank damage, if it is still in fire, and UF_6 emission continues with steady rate. Fuel of vehicle or other combustible materials will finish after 30 min, stop and cool. In this step, emission rate reduces and temperature reaches to 133°F. Cool emission step for 48G cylinder is about 91 min and for 48Y cylinder is 206 min. (time is more for 48Y cylinder, because it has more capacity)

Second method is similar to the previous method by this difference that, it is assumed cylinder has deficit from the beginning (hydraulic damage isn’t formed by pressure). This method is based on air plane collide with cylinder that first collide happens. The initial emission rate is zero at the beginning, but it will increase by time increase. When emission in cooling step happens after 30 min, conditions will be similar to the first method.

Summary of 6FLRE and SUBLIME model results for the first method for 48G and 48Y cylinders are shown in Tables 5 and 6. Related data to emission rate and temperature are observed in Tables 7 and 8.

UF_6 emission and temperature data

Table 5. Summary of 6FIRE model results.

	Thermal degradation		Primary deficit	
	48G	48Y	48G	48Y
The initial crime UF6 , lb	28000	28000	28000	28000
Time destroyed, min	12.2	23.9	0	0
The combination of demolition, lb (%)				
Solid	24163 (86.3)	21984 (78.5)		
Fluid	3523 (12.6)	4744 (16.9)		
Steam	314 (1.1)	1272 (4.6)		
Reservoir pressure during demolition, psia	670.9	231.8		
Liquid temperature during demolition, o F	284.9	260		
Steam temperature at the time of the destruction, o F	611.5	672.7		
The average temperature in the destruction of the shell, o F	1085	1125		
Initial Release, lb	6016	3837	0	0

Climate conditions

Two climates were studied for each determined conditions previously that the first condition is related to the F stability with wind rate of 1 m/s and the second condition is related to D stability with wind rate of 4m/s. for F stability state, roughness length was 10cm, friction rate (u_*) was 0.02 m/s and 5m length was considered for Monin-Obukhov. The boundary height was considered 15m in this condition. For D stability state, friction rate was considered 0.32 m/s, Monin-Obukhov length was about 150 m, and the length of temperature inversion was considered 500m. The summary of these assumptions are shown in Table 7:

Table 6. Summary of SUBLIME model results.

	Thermal degradation		***Primary deficit***	
	48G	48Y	48G	48Y
Fire destroyed until the end of time, min	17.8	6.1	30	30
Sublimation value at the time of the fire, lb	2975	924	4240	3213
Steam temperature at the end of the fire, ° F	912	882	912	905
Sublimation steam after the fire, lb	1192	2670	1192	2733
Release time after the fire, min	91.4	205.7	91.4	201\6.1
All UF_6 released, lb % UF_6 primary	8004 (28.6)	9610 (34.3)	5432 (19.4)	5946 (21.2)

Table 7. Summary of climate conditions

Condition	Wind speed m / s	Friction speed m / s	Length, m (Monin-Obukhov)	Mixing height M
Stability F	1	0.02	5	15
Sustainability D	4	0.32	-150	500

EMISSION STEP BEHAVIOR

In this step, emission step behavior includes hydraulic damages and emission in fire then cooling step. For each emission explained in previously, several cylinders are involved, but it is assumed that each one act individually and so each cylinder condition must be studied individually. As it was described previously, UF_6 react immediately after emission and produce HF and UO_2F_2 after hydrolysis. These materials with surrounding air produce flotation mixture.

Emission by resulted hydraulic damages from heat

As it was mentioned previously, 48Y and 48G cylinders put in fire after 12 and 24 min will be damaged. As it was mentioned previously, products of each damaged cylinder are formed individually and each one will move separately.

While cylinder is broken, UF_6 will emit as solid, liquid, and gas. UF6 will change to vapor and solid for reducing pressure. The obtained vapor reacts with the present water vapor as a mixture of air-UF_6 and hydrolyzes the products. Movement and rotation of these materials depend on mass concentration and its flotation. Main reasons that play role in mass flotation will be as following:

- UF_6 is a very condensed gas at standard temperature and pressure (relatively about 14 kg/m3). This density is so effective on flotation and reduces it. Density increase and concentration accumulation near ground are observed without increase in temperature while UF_6 emission or mass temperature reduction.
- Heat will enter to the initial mass, because UF_6 reaction with water vapor is an exothermic reaction:

$$UF_6 + 2H_2O \rightarrow$$
$$UO_2F_2 + 4HF + 101.5 kj/mol, UF_6$$

Two mole water is needed for each UF_6 mode in this reaction. Water vapor for this reaction is provided by the obtained gases from combustion or environment air permeation inside UF_6 mass. It must be mentioned that the provided water vapor by combustion gases will be negligible in comparison to the vapor in air, because the produced vapor from combustion is about 1 kg/S.

- the obtained gases from combustion having high temperature around cylinders and finally mixing with UF_6 mass increase mass temperature and consequently add on floatation state.

It is observed in each resulted combustion that about 50 to 75 m^3 air in the initial seconds of emission are mixed with each m^3 UF_6 gas and penetrates in UF_6 mass. It is assumed in this article that each 75m^3 air penetrates in 1 m^3 of UF_6. Of course, this assumption will be so conservative, but since the transferred concentration by wind will increase penetration, it is a good assumption for other safety considerations. If penetration amount is considered low, it means mass is condensed in this time and will be precipitated on ground. Then, ratio is considered 75 to 1. Temperature and flotation will be determined by writing a mass and enthalpy balance. Enthalpy changes will be resulted by the following cases in calculation flotation:

- Penetration of combustion gases

- Hydrolysis reaction
- Sublimation of solid to vapor UF_6

The assumptions in 48G tank calculations are listed in following. Similar assumptions can be considered for 48Y cylinder:

- Total emitted UF_6 is 1744 kg. This amount is 143 kg vapor in 828K and remained 1601 kg was liquid. This liquid will change to the solid-vapor mixture immediately in 330K. Finally, 75.5% of total input mass of emission will be vapor and the rest will be solid.
- In the initial seconds of combustion, 500m^3 combustion air enters to mass in 1475F and also 10300m^3 environment air with 300K. This amount of entering combustion air to UF_6 mass is relatively 4 seconds volume of combustion by combustive material.
- Hydrolysis reaction produces 101.5 kj/mol heat; therefore, 502886 kj heat will be produced by this assumption that the mentioned reaction happens in initial seconds after emission.
- Changing 24.5% of UF_6 that was emitted in soiled form to gaseous form with energy consumption of 47.6 kj/mol of solid UF_6.
- According to assumptions, mass will express as a cylinder with 16m radius and height. The volume and temperature of this mass includes HF-air-UO_2F_2 mixture about 344K and 1.138 kg/m^3. (density of surrounding air is 1.174 kg/m^3)

Emission in fire

After hydraulic destruction of tank, UF6 is sublimated and changes to vapor. The produced vapor changes to HF and UO_2F_2 quickly and enters to fire. The entering mass to fire is floated and the following assumptions are considered for this step:

- Fire diameter of 5m
- Fire temperature of 1075K
- Froude number of 0.8

The negative flotation of UO_2F_2 in comparison to high flotation of combustion will be neglected. (Fire produces 100m^3/s combustion gas)combustion air flotation is about 0.75 and according to UF6 emission velocity in fire, it will be 1.7 kg/s, therefore, the flotation of the produced mixed mass reaches to 0.74 for heavy particles of UO_2F_2 that has 1% reduction than the previous state.

Emission in cooling duration

After fire stopping, UF_6 emission continues permanently like emission from cold cylinder. This emission is called “cooling-down” step. The mentioned emission for 48G and 48Y cylinders will takes time 91 and 205 min.

DISCUSSION AND CONCLUSION

The only important radioactive materials in uranium enrichment plant are Uranium hexafluoride, uranium tetra-fluoride and uranium fluoride. The both liquid and gaseous forms of UF_6 that are usually with its solid form, will react with water and water stream immediately in adjacency to them and produce HF reaction. Of this reaction is done in gaseous form and in specific high temperatures, it will be fast and spontaneous. The most important issue about HF is its reaction and mixture ratio with water. It must be mentioned that this molecule can solve in any ratio in water and doesn’t have any restriction about ratio of solving in water.

This article studied the methods of UF_6 emission in environment and contaminations were analyzed in all conditions in various intervals. The obtained summaries are in the following Table. First an accident is described that 48G cylinder was fired and damaged hydraulically, and F and D stability conditions are mentioned. In the next parts, the related summary of results is stated in other emission methods. For 5 emission methods, the statements are mentioned as T1 to T5 in Table 8 and letters “a” and “b” shows results for UO_2F_2 and HF.

The emitted mass by fire in high temperature and also affluent combustion gases has high flotation and rising. This mass won’t contact with ground, while the resulted emission in cooling step make small mass contact ground.

According to the mentioned issues, the dominant conditions on UF_6 emission in enrichment plans that are damaged in accidents are described, and it must be noticed that all described results and formulas in text are experiment and were introduced by references and were tested by assumptions. The experiments and UF_6 hydrolysis products measurement were so difficult and need specific measuring instruments that are not accessible for public, and they can just be adapted to the obtained results by scientists according to the condition of plants of Iran and formulas to test their accuracy.

The permitted values necessary for personal health that are in contact with the emitted materials are shown in Table 8. The mean duration that was determined for toxicity is 1-60 second. As it was discussed, the worst conditions to combine average time and concentration are mentioned in wind direction as follows.

Table 8. Five proposed accidents specifications

statement	***Accident type and involving materials***
T1a	Vehicle fire, full of three-cylinder type 48G , UO_2F_2
T1b	Vehicle fires, three-cylinder full of 48G, HF
T2a	Vehicle fires, three-cylinder full of type 48Y, UO_2F_2
T2b	Vehicle fires, three-cylinder full of type 48Y, HF
T3a	Aircraft collision and fire, two cylinders of the type 48G, UO_2F_2
T3b	Aircraft collision and fire, two cylinders of the type 48G, HF
T4a	Aircraft collision and fire, two cylinders of type 48Y, UO_2F_2
T4b	Aircraft collision and fire, two cylinders of type 48Y, HF
T5a	Vehicle fires, two cylinders waste, UO_2F_2
T5b	Vehicle fires, two cylinders waste, HF

Table 9. Toxicity values for HF and UO_2F_2

Average time Min	***HF***		***UO_2F_2***	
	Potential irreversible effects (mg/m^3)	Potential adverse effects (mg/m^3)	Potential irreversible effects (mg/m^3)	Potential adverse effects (mg/m^3)
1	57	5.7	1600	520
2	57	5.7	780	260
3	57	5.7	520	170
4	57	5.7	390	130
5	57	5.7	310	100
6	52	5.2	260	86
7	48	4.8	220	74
8	45	4.5	190	65
9	42	4.2	170	58
10	40	4	160	52
11	38	3.8	140	47
12	37	3.7	130	43
13	35	3.5	120	40
14	34	3.4	110	37
15	33	3.3	100	35
16	32	3.2	97	32
17	31	3.1	91	30
18	30	3	86	29
19	29	2.9	82	27
20	28	2.8	78	26
21	28	2.8	74	25
22	27	2.7	71	24
23	26	2.6	68	23
24	26	2.6	65	22
25	25	2.5	62	21
26	25	2.5	60	20
27	24	2.4	58	19
28	24	2.4	55	18
29	24	2.4	54	18
30	23	2.3	52	17

Table 10. Central line UO_2F_2 concentrations in wind direction for T1 and F1 stability conditions

Space In wind direction, m	*Density (Mg / m 3)*	*Average time (Sec)*	*Increase the scope irreversible effects*	*Greater than the range of harmful effects*
does not exist	does not exist	3600	0.1	100
does not exist	does not exist	3600	0.07	150
does not exist	does not exist	3600	0.04	250
does not exist	does not exist	3600	0.07	305
does not exist	does not exist	3600	0.2	350
does not exist	does not exist	3600	0.29	368
does not exist	does not exist	3600	0.78	450
does not exist	does not exist	3600	1.6	550
does not exist	does not exist	3600	2.6	650
does not exist	does not exist	3600	4.7	750
does not exist	does not exist	3600	6	805
does not exist	does not exist	3600	6.6	840
does not exist	does not exist	3600	6.4	850
does not exist	does not exist	3600	7.5	920
does not exist	does not exist	3600	7.9	1210
exist	does not exist	3600	8.7	1350
exist	does not exist	3600	9.2	1450
exist	does not exist	3600	14	2414
exist	does not exist	3600	13	4023
exist	does not exist	3600	10	6532
exist	does not exist	3600	8.8	7241
does not exist	does not exist	3600	5.1	12068

Table 11. Central line HF concentrations in wind direction for T1 in F1 stability conditions

Space in wind direction, m	*Density (Mg / m 3)*	*Average time (sec)*	*Increase the scope irreversible effects*	*Greater than the range of harmful effects*
does not exist	does not exist	3600	0.026	100
does not exist	does not exist	3600	0.018	150
does not exist	does not exist	3600	0.011	250
does not exist	does not exist	60	0.46	305
does not exist	does not exist	60	1.8	350
does not exist	does not exist	60	2.8	368
does not exist	does not exist	60	6.8	450
does not exist	does not exist	60	13	550
does not exist	does not exist	60	16	650
does not exist	does not exist	60	30	750
does not exist	does not exist	60	33	805
does not exist	does not exist	60	35	840
does not exist	does not exist	60	36	850
does not exist	does not exist	60	41	920
does not exist	does not exist	60	28	1210
exist	does not exist	60	28	1350
exist	does not exist	60	26	1450
exist	does not exist	750	15	2414
exist	does not exist	1200	8.5	4023
exist	does not exist	1800	4.6	6532
exist	does not exist	2100	3.2	7241
does not exist	does not exist	3600	1.3	12068

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