

JEITA View Concerning Effects of Radioactive Materials Released from Fukushima Nuclear Power
Plant on Semiconductor LSI Products

Soft Error PG

Technical Committee on Semiconductor Reliability

Semiconductor Jisso & Product Technology Committee

Japan Electronics and Information Technology Industries Association

JEITA expresses its view concerning effects of radioactive materials released from the Fukushima nuclear power plant (hereafter, referred to as "Fukushima NPP") on semiconductor LSI products manufactured in Japan as follows:

This expression is based on the fact that there are no Japanese semiconductor factories within official evacuation zone with 20mSv/y or higher as of Jun. 2011.

1. Premise

This view discusses the effects radioactive materials released from the Fukushima NPP where an accident has been occurring (hereafter, referred to as "released radioactive materials") on semiconductor LSI products contaminated by the released radioactive materials (hereafter, referred to as "contaminated LSI products"), and does not cover LSI products only intentional placed near the Fukushima NPP.

2. View

Packing of semiconductor LSI products is performed at an indoor environment where outdoor contaminants are cut off to prevent any direct contamination. The released radioactive materials will, therefore, neither directly contaminate semiconductor LSI products nor cause even the contaminated LSI products to malfunction and soft errors for the following reasons:

- 1) The released radioactive materials currently confirmed out of the Fukushima NPP premises, shown in Table-1, undergo beta or gamma emission process, and emit neither alpha particles nor neutrons that could induce malfunction and soft errors in semiconductor LSI products.
- 2) There was no experience of malfunction and soft errors in semiconductor LSI products by beta or gamma ray from the radioactive materials. They will not cause even the contaminated LSI products to malfunction and soft errors.
- 3) Plutonium²³⁹ that emits alpha particles during its decay process has been reported to be detected. Even if the Plutonium 239 has been released out of the Fukushima NPP premises and has contaminated packed LSI products, such an LSI products itself, inside packing, will not be affected because the alpha particles have a short range. (See Supplement A-1)

Supplement A-1 : Range of alpha particles in semiconductor device

Packing of semiconductor LSI products is generally performed at an indoor environment where outdoor contaminants are cut off to prevent any direct contamination. The released radioactive materials will, therefore, neither directly contaminate semiconductor LSI products nor cause even the contaminated LSI products to malfunction. An estimated energy of alpha particles from contaminated semiconductor devices is about 5MeV. In major semiconductor materials (such as mold compounds, polyimide, aluminum, silicon, copper), the range of the alpha particles is limited to < 30um at 5MeV, according to JEITA-EDR4705 and JESD89A. Typical packaged semiconductor LSI component has a surface package thickness of 0.1 to 1.0mm in thinner plastic mold resin type, which is adequately thicker than 30um of the foregoing range of alpha particles.

Alpha particles will not, therefore, cause packaged semiconductor LSI products to malfunction.

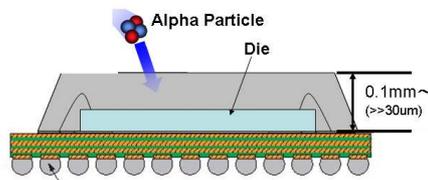


Figure-1 : Schematic image of alpha particles irradiation on semiconductor LSI product
(Mold resin is too thick for alpha particle to reach a die.)

Supplement A-2 : Airborne nuclide

Airborne nuclides monitored at KEK (High Energy Accelerator Research Organization) are shown in Table-1. Table-1 bears the airborne nuclides detected during the period from March 22nd to 23rd 2011.

Table-1 : Airborne nuclides monitored at KEK

| Nuclide | Half life | Decay (*1) |
|---------------|-------------|-------------|
| Iodine131 | 8.021 days | Beta/ Gamma |
| Iodine133 | 20.8 hours | Beta/ Gamma |
| Tellurium129 | 33.6 days | Beta/ Gamma |
| Tellurium132 | 3.204 days | Beta/ Gamma |
| Caesium134 | 2 years | Beta/ Gamma |
| Caesium136 | 13.1 days | Beta |
| Caesium137 | 30.04 years | Beta/ Gamma |
| Technetium99m | 6 hours | Beta/ Gamma |

*1: "Gamma" indicates gamma emission.

To view the monitoring results by KEK (High Energy Accelerator Research Organization), access

<http://www.kek.jp/quake/radmonitor/GeMonitor3-e.html>