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# **Pathological Archives of Life-Span Animal Studies on Carcinogenesis Following Internal Exposures to Plutonium Compounds**

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## Preface

About 30 years ago, the first Japanese pioneer research project was started at NIRS on plutonium-hazards as corresponding to increasing concerns about the risk assessment and radiation protection for plutonium compounds associated closely with the development of fast breeder reactor and plutonium recycling procedures in Japan. This research project conducted by Dr.H.Eto was commenced in April 1966, completed in March 1970, and thereafter, in the last part of 1970s, was again proposed by the then Japan Atomic Energy Committee to process the new research project on the biological effects of plutonium compounds, which needed the establishment of the first and unique research facility available for long-term animal experiments using variable species including beagle dogs, radioprotection for the usage of plutonium compounds and nuclear security. The research project organized by Dr.O.Matsuoka was initiated from 1980, while the new research facility including the disposal plant was finally completed in 1988. Then actual experimental studies including inhalation exposures of animals to plutonium oxide aerosols was started by coordination of Dr.J.Inaba from 1990, and a lot of results were obtained during the recent decade of 1990 - 2000 concerning the development for aerosol generation and assessment, biokinetics and metabolic behaviors of internally deposited plutonium, the development for whole-body counting and microdosimetry of plutonium distributed in the lung, the risk for pulmonary and bone carcinogenesis after inhalation or injection of plutonium compounds, and decorporation and resultant risk mitigation of contaminated plutonium in the body. However, our life-span studies on carcinogenesis particularly at lower dose ranges as well as molecular mechanisms leading to carcinogenesis have continued from 2001 to finally complete and summarize experimental data needed for the risk assessment and complement to guidelines for radiation protection.

The idea for a kind of archives to summarize and review of the above described results, particularly those on carcinogenesis, was naturally originated in the process of arrangements of individual animal data from experimental studies by the request of Dr.G.B.Gerber who took our data into account for the data base of European Radiobiology Archives, and strongly inspired to make the outlines more clear by the book, "Life-Span Effects of Ionizing Radiation in the Beagle Dog, edit. R.C.Thompson, PNL" which was given in Sendai on the occasion of the annual meeting for radiation research society by Dr.C.R.Watson, PNL. Now, we are obliged to establish the archives to review the outlines of all the experimental studies and summarize each of individual animal data on plutonium-induced carcinogenesis as a memorial that we have certainly been engaged in such a unique research project in Japan for almost two decades, and further to list up as many the preserved specimens as possible, including paraffin-embedded tissue blocks and histological slides or microscopic pictures of induced tumors for expectation of scientific contribution of them to users, probably scientists from the world, who intend to reanalyze or compare with other data on radiation carcinogenesis. In this respect, this publication should be written in English as easily and simply as possible. It would be great pleasure for this little book to help something for or correspond to people who have interest in such experimental data and want to try to develop new experimental research by themselves in future.



Finally, we would like to express gratitude to many of our colleagues who had performed together a lot of experiments from the design to discussion; particularly, Dr. Yuji Yamada for his excellent and effortive aerosol technology, Dr. Nobuhito Ishigure for his accurate and logical dosimetry, Mr. Haruzo Iida for his careful support for animal experiments, Mr. Isao Takahashi for his helpful and devoted support for animal cares and preparations of histological specimens, and Mr. Akira Koizumi for his arrangements for radioprotection as well as encouragement to complete studies. As well, we would like to report with some pride the completion of this book to our previous supervisors, Drs. Osamu Matsuoka and Jiro Inaba who had organized and conducted us continuously to the fruitful goal of this great research project.

A handwritten signature in black ink, reading "Yoichi Oghiso". The signature is written in a cursive, flowing style with a long horizontal line extending from the end.

Yoichi Oghiso  
Author-in-chief  
February 2006

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## 1. Introduction

The animal studies on the biological effects of internal exposures to transuranium elements have actually started in 1990 to elucidate particularly the risk for carcinogenesis as well as the risk mitigation for radioprotection following internal exposures to plutonium compounds. While many researchers and specific fields of sciences contributed to the inhalation studies on aerosol generation and assessment, biokinetics and behaviors, and macro- and microdosimetry, this archives covers pathological studies as well as raw data on not only specific but also non-specific tumors in small experimental animals following the intake of plutonium compounds.

In the first section, each of experimental studies was reviewed on the purpose, methods, design and sizes of experimental groups, brief summary of the results obtained, and the publication list of the related papers, respectively. These experimental studies include three sets of experiments on lifetime pulmonary carcinogenesis in the rat following inhalation exposures to  $^{239}\text{PuO}_2$  aerosols, and two sets of comparative experiments using the same strain of rat following both whole-body or thoracic X-ray irradiation, and further three sets of experiments on lifetime carcinogenesis in the mouse following injections of soluble  $^{239}\text{Pu}$  citrate solution, and two sets of comparative experiments on lymphomyeloid neoplasms using the same strains of mice following the injections of chemical carcinogen, MNU or the whole-body  $\gamma$ -ray irradiation, respectively.

In the second section, pathological findings, mainly histopathological diagnosis on tumors observed, were summarized in tables for each animal case from experimental groups as above described; total 23 experimental groups of rats for inhalation exposures to  $^{239}\text{PuO}_2$  aerosols, total 15 groups of rats for X-ray irradiation, total 15 experimental groups of mice for injections of  $^{239}\text{Pu}$  citrate, total 6 experimental groups of mice for MNU-injections, and total 6 experimental groups of mice for  $\gamma$ -ray irradiation, respectively. The data obtained from  $^{239}\text{Pu}$ -exposed animals only referred to the tumors associated with neonatal death or incidental tumors, but not to non-neoplastic causes of death, and excluded the cases of animals which could not be examined due to cannibalism or severe autolysis.

In the third section, selected specimens of neoplasms among all the cases examined for histopathology were listed in tables as for paraffin-embedded blocks, section slides stained with hematoxylin and eosin and other immunohistochemical stainings, and digital microscopic photographs of lung tumors from  $^{239}\text{PuO}_2$ -exposed or X-ray-irradiated rats, bone tumors from  $^{239}\text{Pu}$ -injected mice, and lymphomyeloid neoplasms from  $^{239}\text{Pu}$ -injected, MNU-injected or  $\gamma$ -ray-irradiated mice, respectively. These specimens were only selected from as fresh materials as possible without any postmortem changes, but excluded those of materials that were too old in formalin-fixed states or kept for a long time in the room temperature to examine under an optimal microscopic condition. Cell lines and DNA samples from lung and bone tumors were also listed.

Finally, official reports other than the scientific papers as well as research participants and collaborative researchers were listed in the last part of pages, in order to express our gratitude to all the people associated with this great research project with a confidence for any contribution of this booklet to the scientific basis of the risk evaluation, and a bit help for animal pathologists.

## 2. Review of Experimental Studies

### 2.1 Life-Span Studies on Pulmonary Carcinogenesis in the Rat

The following experimental studies have been performed for about 12 years from 1990 to 2002 to assess the lifetime risk for pulmonary carcinogenesis following inhalation exposures of adult female Wistar strain rats, which show much lower spontaneous lung tumor frequencies, to insoluble, submicron and polydisperse aerosols of high-fired  $^{239}\text{PuO}_2$ , and to compare effectiveness for pulmonary carcinogenesis and cellular and molecular events relevant to carcinogenic mechanisms, respectively, with those of either whole-body or thoracic irradiation with low linear-energy-transfer (LET) radiation, X-rays.

#### 2.1.1 Inhalation Exposures of Rats to $^{239}\text{Pu}$ Dioxide Aerosols for Pulmonary Carcinogenesis

**Purpose:** The lifetime risk evaluation on pulmonary carcinogenesis specific to inhalation exposures to high-fired  $^{239}\text{PuO}_2$  aerosols by establishment of the dose responsiveness for the incidences of malignant lung carcinomas at lower doses.

**Animals:** Female adult Wistar rats, 80-150 days of age at the inhalation exposures

**Inhalation Exposures:**

Single nose-only inhalation exposures of 20 animals at once to submicron and polydisperse aerosols (AMAD: 0.3-0.4  $\mu\text{m}$ , GSD: 1.9-2.2) of high-fired  $^{239}\text{PuO}_2$ , generated through a nebulizer and heated to 1150 °C in a furnace.

**Dosimetry:** Initial lung deposition as determined for each exposed rat under anesthesia on Day 7 after exposures by a whole-body counting of LX-ray with a specific energy of 17 keV. Average cumulative lung doses as calculated during the lifetime from exposures (Day 0) up to death by the time-integral of initial lung deposition, retention function, and the lung weights.

**Endpoints:** Survival periods, causes of death, malignancies and histopathological types of primary lung tumors by histopathological examinations.

**Experimental Groups:**

Total 22 groups from A to C', each containing 20-60 exposed and 10-20 age-matched unexposed control animals as shown in the next page (**Table 1**). Total 660 of exposed animals and total 240 unexposed controls were kept under a barrier-filtered air condition to examine lifetime pulmonary carcinogenesis. About 30 exposed and 20 control animals were used only for lung dosimetry to establish retention function, and about 20 exposed and 10 control animals were excluded from pathological examinations because of severe autolysis and occasionally loss of main organs including the lung due to cannibalism at autopsy.

**Table 1. Summary of Experimental Groups for Life-Span Studies on Pulmonary Carcinogenesis in the Rat Following Inhalation Exposures to  $^{239}\text{PuO}_2$**

Group ID	Date of Birth	Date of Exposure	Age (day) at Exposure	No. of Exposed	No. of Unexposed	AMAD & (GSD)	Mean ILD $\pm$ SD & (range)
A	9/11/90	12/4/90	84	20	10	0.47(2.1)	2050 $\pm$ 407 (1430-2760)
C	3/3/91	6/11/91	99	20	10	0.44(2.0)	636 $\pm$ 252 (81-920)
D	5/1/91	8/6/91	96	20	10	0.40(1.9)	985 $\pm$ 128 (580-1136)
E	6/21/91	10/8/91	108	20	10	0.43(2.0)	1297 $\pm$ 304 (650-1760)
F	8/1/91	12/10/91	130	20	10	0.44(2.0)	1093 $\pm$ 192 (590-1350)
G	9/1/91	2/6/92	157	20	10	0.43(1.9)	1675 $\pm$ 290 (910-2170)
H	10/3/91	2/25/92	145	20	10	0.30(2.0)	791 $\pm$ 86 (650-980)
I	7/1/92	12/1/92	153	40	10	0.44(2.0)	803 $\pm$ 237 (18-1080)
K	6/1/93	9/1/93	92	40	10	0.41(2.0)	174 $\pm$ 63 (35-278)
M	11/1/93	1/21/94	81	20	20	0.27(2.2)	94 $\pm$ 15 (69-121)
N	6/21/94	9/20/94	92	40	10	0.37(1.8)	208 $\pm$ 50 (101-289)
P	10/23/94	1/18/95	87	20	10	0.46(2.0)	463 $\pm$ 103 (252-694)
Q	11/20/94	3/7/95	107	20	10	0.39(2.1)	419 $\pm$ 58 (320-550)
R	3/25/95	6/20/95	87	20	10	0.43(2.1)	282 $\pm$ 55 (155-348)
S	9/15/95	11/28/95	74	40	10	0.46(2.1)	283 $\pm$ 141 (100-605)
T	10/20/95	1/23/96	95	40	10	0.37(2.0)	289 $\pm$ 64 (123-437)
V	3/16/96	6/11/96	87	20	10	0.33(2.4)	38 $\pm$ 8 (26-58)
W	6/20/96	9/18/96	90	40	10	0.33(1.9)	255 $\pm$ 53 (49-325)
X	9/30/96	12/10/96	71	20	10	0.33(2.4)	408 $\pm$ 39 (342-493)
Y	12/24/96	3/11/97	77	40	20	0.39(2.2)	55 $\pm$ 8 (39-68)
B'	5/25/99	9/28/99	126	60	10	0.39(2.0)	42 $\pm$ 11 (23-67)
C'	8/21/99	12/14/99	115	60	10	0.39(2.0)	333 $\pm$ 67 (224-530)
							30 $\pm$ 13 (6-63)
							34 $\pm$ 13 (6-61)



## Summary of Results:

Total 610 exposed and 206 control animals were available for pathological examinations and analyses on the dose effect relationships and risk for pulmonary carcinogenesis. The  $^{239}\text{PuO}_2$ -exposed rats were divided into 9 groups, based on the mean initial lung deposition and lung dose, and the survival period after exposures and the number of primary lung tumors were compared between the control and each of exposed groups as shown below in **Table 2**. The main findings are summarized as follows;

- 1) Significant survival reduction was observed in the groups of exposed rats received the lung dose of 0.45 Gy or more, well correlated with the increase of malignant lung tumors.
- 2) Almost all the malignant lung tumors were carcinomas that drastically increased up to the maximum of about 90 % at 6.6 Gy.
- 3) Differential dose responsiveness was apparently observed among lung tumor types; adenomas at lower doses, adenocarcinomas at middle to higher doses, adenosquamous carcinomas at higher doses, and squamous cell carcinomas at higher doses, respectively.

**Table 2. Survival Period and Lung Tumor Induction in the Rat Following Inhalation Exposures to  $^{239}\text{PuO}_2$**

Group Name	No. Animals	ILD (Bq)	Lung Dose (Gy)	Survival (day)	No. of Primary Lung Tumors	
					Benign	Malignant
Control	206	0	0	817±146	3	1
Pu1	80	24±8	0.16±0.05	855±124	16	1
Pu2	134	65±30	0.45±0.24	764±165	33	12
Pu3	128	228±48	1.59±0.32	765±155	30	60
Pu4	126	416±98	2.76±0.43	692±148	29	78
Pu5	40	787±79	4.67±0.24	675±98	5	32
Pu6	31	948±76	5.43±0.29	622±105	3	27
Pu7	31	1147±114	6.61±0.28	550±82	1	28
Pu8	30	1672±261	8.52±0.67	458±95	0	27
Pu9	10	2430±395	12.2±1.86	372±114	0	7

## Publications:

1. Oghiso, Y., Yamada, Y., Ishigure, N., Fukuda, S., Iida, H., Yamada, Y., Sato, H., Koizumi, A., and Inaba, J. High incidence of malignant lung carcinomas in rats after inhalation of  $^{239}\text{PuO}_2$  aerosol. *J. Radiat. Res.* **35**: 222-235, 1994.
2. Oghiso, Y., Yamada, Y., Iida, H., and Inaba, J. Differential dose responses of pulmonary tumor types in the rat after inhalation of plutonium dioxide aerosols. *J. Radiat. Res.* **39**: 61-72, 1998.
3. Oghiso, Y., and Yamada, Y. Comparisons of pulmonary carcinogenesis in rats following inhalation exposure to plutonium dioxide or X-ray irradiation. *J. Radiat. Res.* **44**: 261-270, 2003.

### 2.1.2 Inhalation Exposures of Rats to $^{239}\text{Pu}$ Dioxide Aerosols for Pathogenetic Processes

**Purpose:** The cellular and pathological events leading to pulmonary carcinogenesis during the period after inhalation exposures to high-fired  $^{239}\text{PuO}_2$  aerosols, as well as estimation of the minimum dose and time required for the initiation of neoplastic lesions.

**Animals:** Female adult Wistar rats, 80-150 days of age at the inhalation exposures

#### **Inhalation Exposures:**

Single nose-only inhalation exposures of 20 animals at once to submicron and polydisperse aerosols (AMAD: 0.3-0.4  $\mu\text{m}$ , GSD: 1.9-2.2) of high-fired  $^{239}\text{PuO}_2$ , generated through a nebulizer and heated to 1150  $^{\circ}\text{C}$  in a furnace.

**Dosimetry:** Initial lung deposition as determined for each exposed rat under anesthesia on Day 7 after exposures by a whole-body counting of LX-ray with a specific energy of 17 keV. Average cumulative lung doses as calculated during the lifetime from exposures (Day 0) up to death or sacrifice by the time-integral of initial lung deposition, retention function, and the lung weights.

**Endpoints:** The time-course changes in constituents of lung cells recovered by a bronchoalveolar lavage, the releasing activities of nitric oxide (NO) and tumor necrosis factor ( $\text{TNF}\alpha$ ) from pulmonary alveolar macrophages (PAM), DNA synthesis of pulmonary epithelium, and microscopic pulmonary lesions including neoplasias by sequential sacrifice of animals on 1, 3, 6, 12, 18 and 24 months after inhalation exposures. Survival periods, causes of death, malignancies and histopathological types of primary lung tumors by histopathological examinations for dead animals during all the examination periods.

#### **Experimental Groups:**

Total 2 groups, Z and A', each containing 40-60 exposed and 10 age-matched unexposed control animals as shown in the next page (**Table 3**). All of these animals were kept under a barrier-filtered air condition, and at least 6 to 10 exposed and at least 3 control animals from each group were sacrificed only for sequential analyses on the cytokinetics, PAM-releasing activities, DNA synthesis and histopathological consequences on the period from 1 to 24 months after exposures. Total 10-15 animals from each group were died early from 155 days to late on 804 days after exposures to be autopsied for histopathological examinations, and only a few exposed animals were excluded from pathological examinations because of severe autolysis and occasionally loss of main organs including the lung due to cannibalism at autopsy.

**Table 3 . Summary of Experimental Groups for Sequential Studies on Pulmonary Carcinogenesis in the Rat Following Inhalation Exposures to  $^{239}\text{PuO}_2$**

Group ID	Date of Birth	Date of Exposure	Age (day) at Exposure	No. of Exposed	No. of Unexposed	AMAD & (GSD)	Mean ILD $\pm$ SD & (range)
Z	1/16/97	4/23/97	97	60	10	0.41(2.3)	188 $\pm$ 55 (35-267) 366 $\pm$ 60 (250-471) 453 $\pm$ 68 (234-558)
A'	3/16/97	6/17/97	93	40	10	0.40(2.1)	374 $\pm$ 66 (222-504)

### Summary of Results:

The main findings on the sequential analyses are summarized as follows;

- 1) Cell yields of lavaged bronchoalveolar cells and PAMs were significantly reduced from 1 to 3 months after exposures, then recovered to the control (unexposed) levels.
- 2) The proportions of multinucleated or micronucleated PAMs significantly increased from 1 month, and sustained up to 18 months after exposures.
- 3) Both NO and TNF activities from the stimulated cultures of PAMs were significantly elevated 1-3 months after exposures, and NO activity was then reduced from 6 to 18 months, while TNF activity again increased from 12 to 18 months after exposures.
- 4) Labeling indices of bronchioloalveolar epithelial cells with BrdU significantly increased from 3 months and sustained up to 18 months after exposures.
- 5) After exudative inflammations during the period of 1 to 3 months after exposures, hyperplasia and metaplasia of the lining bronchioloalveolar epithelium were predominant from 3 to 6 months, while adenomatous and adenocarcinomatous lesions appeared to be developed from 12 months after exposures.
- 6) The appearance of primary lung tumors, mostly adenomas or adenocarcinomas, were found at the doses of 1-2 Gy from 12 months after exposures.

### Publications:

1. Oghiso, Y., and Yamada, Y. Pathogenetic process of lung tumors induced by inhalation exposures of rats to plutonium dioxide aerosols. *Radiat. Res.* **154**: 253-260, 2000.



### 2.1.3 Inhalation Exposures of Rats to $^{239}\text{Pu}$ Dioxide Aerosols for Subcellular Events

**Purpose:** The mutation frequency and profile of *p53* tumor suppressor gene as the most plausible molecular event leading to pulmonary carcinogenesis in the rat following inhalation exposures to high-fired  $^{239}\text{PuO}_2$  aerosols, and identification of cellular origins or target epithelial cells at risk for pulmonary carcinogenesis.

**Animals:** Female adult Wistar rats, 80-150 days of age at the inhalation exposures

#### **Inhalation Exposures:**

Single nose-only inhalation exposures of 20 animals at once to submicron and polydisperse aerosols (AMAD: 0.3-0.4  $\mu\text{m}$ , GSD: 1.9-2.2) of high-fired  $^{239}\text{PuO}_2$ , generated through a nebulizer and heated to 1150  $^{\circ}\text{C}$  in a furnace.

**Dosimetry:** Initial lung deposition as determined for each exposed rat under anesthesia on Day 7 after exposures by a whole-body counting of LX-ray with a specific energy of 17 keV. Average cumulative lung doses as calculated during the lifetime from exposures (Day 0) up to death by the time-integral of initial lung deposition, retention function, and the lung weights.

**Endpoints:** Immunohistochemical detection of long-lived intranuclear p53 proteins, *Tp53* mutations analysed by PCR-SSCP and direct sequence on DNA extracted, and immunohistochemistry for surfactant apoprotein (SP-A) specific to type II pneumocytes or Clara cell antigen (CC-10) as plausible target pulmonary epithelial cells from selected histological paraffin sections of primary lung tumors of  $^{239}\text{PuO}_2$ -exposed rats, respectively

#### **Specimens from Experimental Groups:**

Total 305 histological specimens of primary lung tumors were selected from 22 groups for immunohistochemistry of intranuclear p53 proteins, total 104 specimens from 19 groups for mutation analyses of *Tp53*, and total 146 specimens from 24 groups for immunohistochemistry of both surfactant protein specific to type II pneumocytes and Clara cell antigen as shown in **Table 4**, in addition to only one specimen from the control.

**Table 4. Summary of Selected Specimens from Experimental Groups for Studies on Subcellular Events in the Rat Following Inhalation Exposures to  $^{239}\text{PuO}_2$**

Investigations on	Experimental Group & (No.)	Total No. Specimens	Lung Tumor Types			
			AD	AC	ASC	SCC
Immunohistochemistry of Intranuclear p53 Proteins	Group A - Y (20) Group B' - C' (2)	305	55	160	67	23
Mutation of <i>Tp53</i>	Group A - Y (19)	104	10	35	41	18
Immunohistochemistry of Surfactant Apoproteins	Group A - A' (22) Group B' - C' (2)	146	25	65	37	19

## Summary of Results:

The main findings on each of investigations are summarized as follows;

- 1) The positivity for CM1 antibody to rat p53 proteins was very low in the histological sections of primary lung tumors as shown by the following results; only 9 cases (2.9%) were strongly positive, 48 cases (15.7%) slightly positive, and 248 cases (81.3%) negative among total 305 cases examined. The relevance of the positivity to the histopathological types of tumors was not noted.
- 2) Intact DNA were extracted from 98 cases among total 104 cases examined, and the abnormalities were found in 31 cases (31.6%) by PCR-SSCP analysis of 99 cases, and only 13 cases (13.3%) showed G to A or C to T transitional point mutations by direct sequence of 31 cases. The relevance of the mutation frequency to the histopathological types of lung tumors was not, however, observed.
- 3) Most of adenomas (AD:75%) and adenocarcinomas (AC:82%) were positive for type II pneumocytes-specific SP-A, while 79% of adenomas as well as 47% of adenocarcinomas were positive for Clara cell antigen, CC-10, suggesting that these types of tumors originate from either type II or Clara cells. Adenosquamous (ASC) and squamous cell (SCC) carcinomas were, however, almost negative for both antigens.

## Publications:

1. Oghiso, Y., Yamada, Y., Iida, H., and Inaba, J. Differential dose responses of pulmonary tumor types in the rat after inhalation of plutonium dioxide aerosols. *J. Radiat. Res.* **39**: 61-72, 1998.
2. Yamada, Y. and Oghiso, Y. Mutations in *Tp53* gene sequences from lung tumors in rats that inhaled plutonium dioxide. *Radiat. Res.* **152**: S107-S109, 1999.
3. Oghiso, Y. and Yamada, Y. Immunohistochemical study on cellular origins of rat lung tumors induced by inhalation exposures to plutonium dioxide aerosols as compared to those by X-ray irradiation. *J. Radiat. Res.* **43**: 301-311, 2002.
4. Yamada, Y., Oghiso, Y., Morlier, J.-P., Guillet, K., Fritsch, P., Dudoignon, N., and Monchaux, G. Comparative study on *Tp53* gene mutations in lung tumors from rats exposed to <sup>239</sup>Pu, <sup>237</sup>Np and <sup>222</sup>Rn. *J. Radiat. Res.* **45**: 69-76, 2004.

#### 2.1.4 X-ray Irradiation of Rats for Pulmonary Carcinogenesis

**Purpose:** The dose responsiveness and morphologic characteristics of rat lung tumors induced by whole-body or thoracic X-ray irradiation as compared with those following inhalation exposures to high-fired  $^{239}\text{PuO}_2$  aerosols.

**Animals:** Female adult Wistar rats, mostly 100-150 days of age at irradiation

**Irradiation Regimens:**

The X-ray was generated by using Pantak HF 320S (Shimadzu). For whole-body X-irradiation, 5 animals in a cylindrical Lucite holder were exposed repeatedly to fractionated X-rays by a split dose of 0.5 Gy at a dose rate of 0.1 Gy/min under the condition of 200 kVp and 6.0 mA with 0.5 mm Cu and 0.5 mm Al filters and with FSD of 100 cm by 2- to 3-day intervals to achieve total accumulated dose of 0.5 to 10 Gy. For local, thoracic X-irradiation, 5 anesthetized animals in a rectangular Lucite holder, shielded with a 5 mm-thick lead sheet except for the thorax, were exposed once to a single dose of X-rays at a dose rate of 0.6 Gy/min under the condition of 200 kVp and 20 mA with 0.5 mm Cu and 0.5 mm Al filters and with FSD of 75 cm to achieve total accumulated dose of 1.0 to 10 Gy.

**Dosimetry:** Dose measurement was carried out during all irradiation procedures with a 0.6 ml C-110 ionization chamber in a conjunction with a thermoluminescent dosimeter (model AE-1321M, Applied Engineering Inc.) put onto the central or thoracic position of an empty chamber of the Lucite holder used for the above irradiation regimens. The average total accumulated doses measured were regarded as absorbed doses in the whole lung of each experiment.

**Endpoints:** Survival periods, causes of death, malignancies and histopathological types of primary lung tumors by histopathological examinations.

**Experimental Groups:**

Total 6 groups from X-1 to X-6, each containing 50-80 whole-body X-irradiated and 10-65 age-matched unirradiated control animals, and total 8 groups from X-8 to X-15, each containing 30-60 thoracic X-irradiated and 10-30 unirradiated control animals, respectively as shown in the next page (**Table 5**). Total 650 of X-irradiated animals and total 205 unirradiated controls were kept for their lifetimes to examine lifetime pulmonary carcinogenesis. About 50 animals from these groups were, however, excluded from pathological examinations because of severe autolysis and occasionally loss of main organs including the lung due to cannibalism at autopsy.

**Table 5. Summary of Experimental Groups for Life-Span Studies on Pulmonary Carcinogenesis in the Rat Following X-Irradiation**  
(Whole-Body X-Irradiation)

Group Name	Birth Date	Period of Irradiation Date	Age (day) at Final Irradiation	No. of Irradiated	No. of Unirradiated	Total Dose (Gy)
X-1	3/28/96	6/24/96-7/26/96	120	50	20	0.5-5.0
X-2	7/20/96	-	-	0	65	0
X-3	10/24/96	1/20/97-2/21/97	120	60	0	0.5-5.0
X-4	2/16/97	5/19/97-6/20/97	124	80	0	0.5-5.0
X-5	4/17/97	7/11/97-8/11/97	116	60	20	0.5-5.0
X-6	6/22/97	9/16/97-11/28/97	159	50	10	10.0

**(Thoracic X-Irradiation)**

Group Name	Birth Date	Irradiation Date	Age (day) at Irradiation	No. of Irradiated	No. of Unirradiated	Total Dose (Gy)
X-8	2/20/99	8/25/99	186	40	10	3.0-5.0
X-9	3/27/99	8/26/99	152	40	10	3.0-5.0
X-10	9/23/99	1/7/00	106	45	10	3.0-10.0
X-11	10/26/99	2/3/00	100	45	10	3.0-10.0
X-12	11/22/99	3/9/00	108	45	10	3.0-10.0
X-13	1/25/00	5/2/00	98	45	10	3.0-10.0
X-14	3/21/00	6/30/00	101	30	30	1.0
X-15	5/29/00	9/8/00	102	60	0	1.0

**Summary of Results:**

Almost total 600 exposed and 150 control animals were available for pathological examinations and analyses on the dose effect relationships and risk for pulmonary carcinogenesis. The survival period after the cessation of irradiation and the incidence of primary lung tumors from the controls and each of the groups (A to F for whole-body X-irradiation and G to J for thoracic X-irradiation) of rats were summarized as shown in the next page (**Table 6**). The main findings are summarized as follows;

- 1) Significant survival reduction was observed in the groups of rats received the dose of 2.0 Gy or more for whole-body X-irradiations and 5.0 Gy or more for thoracic X-irradiation, respectively, but mostly due to the increase of malignant and metastatic solid tumors other than lung tumors.
- 2) Most of primary lung tumors were adenomas and adenocarcinomas, both of which significantly increased only at the dose of 5.0 Gy or more in thoracic X-irradiated animals.
- 3) The proportions of each histopathological type of lung tumor lesions distributed in the lungs were almost 50 % adenomas, 30-40% adenocarcinomas, and 10-20% adenosquamous and squamous cell carcinomas.

**Table 6. Survival Period and Lung Tumor Induction in the Rat Following X-Irradiation  
(Whole-Body X-Irradiation)**

Group Name	No. Animals	Dose (Gy)	Survival (day)	No. of Primary Lung Tumors	
				Benign	Malignant
Control	99	0	812±125	1	0
A	46	0.5	780±139	0	1
B	47	1.0	800±163	2	1
C	45	2.0	767±156	3	0
D	47	3.0	711±140	3	3
E	45	5.0	698±131	2	3
F	45	10.0	584±150	3	4

**(Thoracic X-Irradiation)**

Group Name	No. Animals	Dose (Gy)	Survival (day)	No. of Primary Lung Tumors	
				Benign	Malignant
Control	47	0	828±162	1	0
G	70	1.0	803±142	3	3
H	85	3.0	798±128	7	8
I	84	5.0	687±168	11	11
J	53	10.0	577±145	13	8

**Publications:**

1. Oghiso, Y., and Yamada, Y. Comparisons of pulmonary carcinogenesis in rats following inhalation exposure to plutonium dioxide or X-ray irradiation. J. Radiat. Res. 44: 261-270, 2003.

### 2.1.5 X-ray Irradiation of Rats for Subcellular Events

**Purpose:** The mutation frequency and profile of *p53* tumor suppressor gene as the most plausible molecular event leading to pulmonary carcinogenesis in the rat following X-ray irradiation, and identification of cellular origins or target epithelial cells at risk for pulmonary carcinogenesis to compare with those following inhalation exposures to high-fired  $^{239}\text{PuO}_2$  aerosols.

**Animals:** Female adult Wistar rats, mostly 100-150 days of age at irradiation

#### **Irradiation Regimens:**

The X-ray was generated by using Pantak HF 320S (Shimadzu). For whole-body X-irradiation, 5 animals in a cylindrical Lucite holder were exposed repeatedly to fractionated X-rays by a split dose of 0.5 Gy at a dose rate of 0.1 Gy/min under the condition of 200 kVp and 6.0 mA with 0.5 mm Cu and 0.5 mm Al filters and with FSD of 100 cm by 2- to 3-day intervals to achieve total accumulated dose of 0.5 to 10 Gy. For local, thoracic X-irradiation, 5 anesthetized animals in a rectangular Lucite holder, shielded with a 5 mm-thick lead sheet except for the thorax, were exposed once to a single dose of X-rays at a dose rate of 0.6 Gy/min under the condition of 200 kVp and 20 mA with 0.5 mm Cu and 0.5 mm Al filters and with FSD of 75 cm to achieve total accumulated dose of 1.0 to 10 Gy.

**Dosimetry:** Dose measurement was carried out during all irradiation procedures with a 0.6 ml C-110 ionization chamber in a conjunction with a thermoluminescent dosimeter (model AE-1321M, Applied Engineering Inc.) put onto the central or thoracic position of an empty chamber of the Lucite holder used for the above irradiation regimens. The average total accumulated doses measured were regarded as absorbed doses in the whole lung of each experiment.

**Endpoints:** Immunohistochemical detection of long-lived intranuclear p53 proteins, *Tp53* mutations analysed by PCR-SSCP and direct sequence on DNA extracted, and immunohistochemistry for surfactant apoprotein (SP-A) specific to type II pneumocytes or Clara cell antigen (CC-10) as plausible target pulmonary epithelial cells from selected histological paraffin sections of primary lung tumors of X-irradiated rats, respectively

#### **Specimens from Experimental Groups:**

Total 66 histological specimens of primary lung tumors for immunohistochemistry of intranuclear p53 proteins, total 33 specimens for mutation analyses of *Tp53*, and total 64 specimens for immunohistochemistry of both surfactant protein specific to type II pneumocytes and Clara cell antigen were selected from 13 groups, respectively as shown in the next page (Table 7).

**Table 7. Summary of Selected Specimens from Experimental Groups for Studies on Subcellular Events in the Rat Following X-Irradiation**

Investigation Assays for	Experimental Groups & (No.)	Total No. Specimens	Lung Tumor Types			
			AD	AC	ASC	SCC
Immunohistochemistry of Intranuclear p53 Proteins	Group X-1 to X-6 (6) Group X-8 to X-14 (7)	66	29	28	2	7
Mutation of <i>Tp53</i>	Group X-1 to X-6 (6) Group X-8 to X-14 (7)	33	11	17	1	4
Immunohistochemistry of Surfactant Apoproteins	Group X-1 to X-6 (6) Group X-8 to X-14 (7)	64	27	28	2	7

### Summary of Results:

The main findings on each of investigations are summarized as follows;

- 1) The positivity for CM1 antibody to rat p53 proteins was very low in the histological sections of primary lung tumors as shown by the following results; none the positive cases, only 3 cases (4.5%) slightly positive, and most 63 cases (95.5%) negative among total 66 cases examined. The relevance to the histopathological types of tumors was not noted, and no differences between whole-body and thoracic X-irradiation.
- 2) Intact DNA were extracted from 29 cases among total 33 cases examined, and the abnormalities were found in 9 cases (31.0%) by PCR-SSCP analysis of 29 cases, but only one case (3.4%) showed C to T transitional point mutations by direct sequence of 9 cases.
- 3) Most of adenomas (AD:80%) and adenocarcinomas (AC:74%) were positive for Clara cell antigen, CC-10, while 53% of adenomas and 74% of adenocarcinomas were positive for type II pneumocytes-specific SP-A, suggesting that these types of tumors originate from either type II or Clara cells. Adenosquamous (ASC) and squamous cell (SCC) carcinomas were, however, negative for both antigens.

### Publications:

1. Oghiso, Y. and Yamada, Y. Immunohistochemical study on cellular origins of rat lung tumors induced by inhalation exposures to plutonium dioxide aerosols as compared to those by X-ray irradiation. J. Radiat. Res. **43**: 301-311, 2002.



## 2.2 Life-Span Studies on Carcinogenesis in the Mouse

The following experimental studies have been performed for about 11 years from 1991 to 2002 to assess the lifetime risk, spectrum and pathogenetic processes for carcinogenesis following injections of soluble  $^{239}\text{Pu}$  citrate solutions into three strains of adult female mice, which show different spontaneous and external radiation-induced tumor spectra, and to compare carcinogenicity and subcellular mechanisms specific to plutonium compounds with those of either chemical carcinogen-administered or  $\gamma$ -ray irradiated mice, respectively.

### 2.2.1 Injections of $^{239}\text{Pu}$ Citrate Solution into C3H Mice for Carcinogenesis

**Purpose:** The lifetime risk evaluation on bone and the other tumors specific to injected, soluble  $^{239}\text{Pu}$  citrate solution into C3H mice which are recognized to show higher frequency of spontaneous hepatocellular carcinomas, but much less frequencies or none of lymphomyeloid neoplasms and bone tumors.

**Animals:** Female adult C3H strain mice, 90-110 days of age at the time of injections.

**Injections:** Single intraperitoneal injections of monomeric  $^{239}\text{Pu}$  citrate solution (pH 6.8 to 7.2) diluted with physiological saline into different amounts of activities; 10, 100, 500, 1000, 5000 and 10000 Bq/animal, respectively.

**Dosimetry:** The separate group of mice received 1000 Bq/animal of  $^{239}\text{Pu}$  citrate was sequentially sacrificed to measure the concentration of the retained activity in the ashed bones in a liquid scintillation spectrometer, resulting in the negatively exponential skeletal retention function. The cumulative mean skeletal dose for each animal until death was calculated by the time integral of the injected dose (Bq) and skeletal retention function.

**Endpoints:** Survival periods, causes of death, spectrum and distribution of tumors observed, particularly bone tumors and lymphoid neoplasms by histopathological examinations.

#### Experimental Groups:

Total 5 groups from IP1 to IP5, each containing 50-55 injected and 20 age-matched, saline-injected (carrier) control animals as shown in **Table 8**. Another separate group of 30 animals received 1000 Bq/animal was used for sequential analysis of skeletal retention as described above.

**Table 8. Summary of Experimental Groups for Life-Span Studies on Carcinogenesis in C3H Mice Following Injections of  $^{239}\text{Pu}$  Citrate Solution**

Group Name	Mouse Strain	Birth Date	Injection Date	Age (day) at Injection	No. of Pu-Injected	No. of Controls	Injected Dose (Bq)
IP1	C3H	5/1/91	8/7/91	98	50	20	500-10000
IP2	C3H	7/2/91	10/17/91	107	55	20	500-10000
IP3	C3H	9/13/91	12/12/91	90	55	20	500-10000
IP4	C3H	2/11/93	5/28/93	106	50	20	10-100
IP5	C3H	5/2/93	7/30/93	89	50	20	10-100

### Summary of Results:

Total 260 injected and 100 control animals were available for postmortem pathological examinations and analyses on the survivals, neoplastic or non-neoplastic death, and the dose effect relationships for bone or lymphoid tumors observed. The  $^{239}\text{Pu}$ -injected mice were divided into 8 groups, based on the injected dose and skeletal dose, and the mean survival time and number of tumors in each group were shown as below in **Table 9**. The main findings are summarized as follows;

- 1) Significant survival reduction was observed at the mean skeletal dose of 2.93 Gy or more, resulted from an earlier increase of neoplastic or non-neoplastic death.
- 2) Almost all the bone tumors were osteosarcomas, and were not found in the controls but increased drastically to a maximum incidence of 96% at 6.92 Gy, while non-thymic but pre-B cell type lymphomas were not found in the controls and at the doses of less than 6.92 Gy but increased up to a maximum incidence of 36% at the higher doses more than 10 Gy.
- 3) The other solid tumors rather decreased at the doses of 2.93 Gy or more, and no myeloid leukemias were found in the controls and all the groups of  $^{239}\text{Pu}$ -injected animals.

**Table 9. Survival Period and Tumor Induction in C3H Mice Following Injections of  $^{239}\text{Pu}$  Citrate**

Group Name	No. Animals	Injected Dose (Bq)	Skeletal Dose (Gy)	Survival (day)	No. of Tumor-Bearers		
					Bone	Lymphoid	Others
Control	100	0	0	767 $\pm$ 89	0	20	58
Pu 1	50	10	0.067 $\pm$ 0.01	724 $\pm$ 138	1	5	28
Pu 2	50	100	0.693 $\pm$ 0.115	732 $\pm$ 165	6	4	27
Pu 3	30	500	2.93 $\pm$ 0.48	511 $\pm$ 118	8	2	4
Pu 4	30	500-1000	4.66 $\pm$ 0.68	467 $\pm$ 117	13	0	3
Pu 5	25	1000-5000	6.92 $\pm$ 0.67	480 $\pm$ 64	24	0	1
Pu 6	25	5000	17.3 $\pm$ 2.6	320 $\pm$ 48	12	6	0
Pu 7	25	5000-10000	25.5 $\pm$ 3.7	344 $\pm$ 81	8	9	0
Pu 8	25	10000	42.4 $\pm$ 2.8	395 $\pm$ 40	5	3	0

### Publications:

1. Oghiso, Y., Yamada, Y., and Iida, H. Differential induction of bone and hematopoietic tumors in C3H mice after the injection of  $^{239}\text{Pu}$  citrate. J. Radiat. Res. **35**: 236-247, 1994.
2. Oghiso, Y., Yamada, Y., and Iida, H. High frequency of leukemic lymphomas with osteosarcomas but no myeloid leukemias in C3H mice after  $^{239}\text{Pu}$  citrate injection. J. Radiat. Res. **38**: 77-86, 1997.

### 2.2.2 Injections of $^{239}\text{Pu}$ Citrate Solution into Different Strains of Mice for Carcinogenesis

**Purpose:** The lifetime risk evaluation on bone and the other tumors specific to injected, soluble  $^{239}\text{Pu}$  citrate solution into different strains of mice that are recognized to show different spectra of spontaneous or radiation-induced tumors.

**Animals:** Female adult C3H/HeN, C57BL/6J, and B6C3F<sub>1</sub> strains of mice, 70-140 days of age at the time of injections.

**Injections:** Single intraperitoneal injections of monomeric  $^{239}\text{Pu}$  citrate solution (pH 6.8 to 7.2) diluted with physiological saline into different amounts of activities; 100, 500, 1000, 5000 and 10000 Bq/animal, respectively.

**Dosimetry:** The separate group of mice received 1000 Bq/animal of  $^{239}\text{Pu}$  citrate was sequentially sacrificed to measure the concentration of the retained activity in the ashed bones in a liquid scintillation spectrometer, resulting in the negatively exponential skeletal retention function. The cumulative mean skeletal dose for each animal until death was calculated by the time integral of the injected dose (Bq) and skeletal retention function.

**Endpoints:** Survival periods, causes of death, spectrum and distribution of tumors observed, particularly bone tumors and lymphoid neoplasms by histopathological examinations.

#### Experimental Groups:

Total 18 groups from IP7 to IP14, each containing 10-33 injected and 10-20 age-matched, saline-injected (carrier) control animals as shown in **Table 10**.

**Table 10. Summary of Experimental Groups for Life-Span Studies on Carcinogenesis in 3 Strains of Mice Following Injections of  $^{239}\text{Pu}$  Citrate**

Group Name	Mouse Strain	Birth Date	Injection Date	Age (day) at Injection	No. of Pu-Injected	No. of Controls	Injected Dose (Bq)
IP7-1	C3H	4/12/96	6/21/96	70	30	20	100
IP7-2	C57	3/26/96	6/21/96	87	30	20	100
IP7-3	BC3	3/26/96	6/21/96	87	31	20	100
IP8-1	C3H	10/1/96	1/14/97	105	30	20	500
IP8-2	C57	9/10/96	1/14/97	126	31	20	500
IP8-3	BC3	10/1/96	1/14/97	105	33	20	500
IP9-1	C3H	2/25/97	6/27/97	122	30	20	1000
IP9-2	C57	2/5/97	6/27/97	142	32	20	1000
IP9-3	BC3	2/25/97	6/27/97	122	33	20	1000
IP10-1	C3H	9/11/97	12/19/97	98	11	10	5000
IP10-2	C3H	9/11/97	12/19/97	98	10	10	5000
IP10-3	C3H	9/11/97	12/19/97	98	11	10	5000
IP11-1	C3H	3/24/98	6/25/98	93	21	10	5000
IP11-2	C57	3/10/98	6/25/98	107	21	10	5000
IP11-3	BC3	3/24/98	6/25/98	93	21	10	5000
IP12	C3H	4/11/00	8/4/00	115	30	10	10000
IP13	C57	6/13/00	10/6/00	115	30	10	10000
IP14	BC3	8/15/00	12/15/00	122	32	10	10000

## Summary of Results:

Total 467 injected and 180 control animals from three strains were available for postmortem pathological examinations and analyses on the survivals, neoplastic or non-neoplastic death, and the dose effect relationships for bone or lymphoid tumors observed. The  $^{239}\text{Pu}$ -injected mice from each strain were divided respectively into 5 groups, based on the injected dose and skeletal dose, and the mean survival time and number of tumors in each group were shown in the next page (**Table 11**). The main findings are summarized as follows;

- 1) Significant survival reduction was observed in all the strains of mice received 500 Bq or more, resulted mostly from an early increase of bone tumors.
- 2) Most of the bone tumors from all the strains of mice were osteosarcomas, and increased in a dose-dependent manner to a maximum incidence of 50-63% at the mean skeletal dose of 2-3 Gy.
- 3) Lymphoid neoplasms observed in all the strains of mice received 5000 Bq or more appeared early and were characterized by pre-B-cell lymphomas derived from progenitor B-cells.
- 4) The other solid tumors rather decreased in all the strains of mice received 500 Bq or more, and none or fewer myeloid leukemias were found in the controls and all the groups of  $^{239}\text{Pu}$ -injected animals.
- 5) As the trials of molecular approach for osteosarcomagenesis, PCR-SSCP analysis was performed on mutations of *Tp53* tumor suppressor gene, or *K-ras*, *H-ras* and *N-ras* oncogenes. Even though total 11 cases of osteosarcomas, available for DNA extraction from fresh and frozen samples, were examined, only one case showed C to A transversion point mutation on the exon 7 of *Tp53*.
- 6) Non-neoplastic lesions from the control and  $^{239}\text{Pu}$ -injected mice were mostly distributed in the liver and kidneys, and rarely in the spleen, lung and heart, including fatty degeneration and necrosis of hepatocytes, glomerulonephritis or interstitial nephritis, splenic Gandy-Gamna-like body, idiopathic pulmonary alveolar proteinosis (IPAP)-like alveolar surfactant accumulation, and myocardial or periarteriolar fibrosis, while any specific dose responsiveness for these lesions was not seen, as well as strain differences in the appearance.

## Publications:

1. Oghiso, Y. and Yamada, Y. Carcinogenesis in mice after injection of soluble plutonium citrate. *Radiat. Res.* **152**: S27-S30, 1999.
2. Oghiso, Y. and Yamada, Y. The specific induction of osteosarcomas in different mouse strains after injections of  $^{239}\text{Pu}$  citrate. *J. Radiat. Res.* **44**: 125-132, 2003.
3. Oghiso, Y. and Yamada, Y. Pre-B-cell lymphomas in mice following injection of  $^{239}\text{Pu}$  citrate: Comparison with MNU-injected T-lymphoblastic lymphomas. *J. Toxicol. Pathol.* **16**: 93-102, 2003.

**Table 11. Survival Period and Tumor Induction in 3 Strains of Mice Following Injections of  $^{239}\text{Pu}$  Citrate**

Group Name	No. Animals	Injected Dose (Bq)	Skeletal Dose (Gy)	Survival (day)	No. of Tumor-Bearers		
					Bone	Lymphoid	Others
<b>C3H</b>							
Control	60	0	0	763±136	0	10	33
Pu 1	30	100	0.68±0.04	808± 81	4	0	11
Pu 2	30	500	2.71±0.35	592±105	19	0	3
Pu 3	30	1000	4.42±0.57	454± 72	14	0	0
Pu 4	32	5000	16.3±2.2	314± 50	15	2	0
Pu 5	30	10000	32.2±5.8	309± 67	8	3	0
<b>C57</b>							
Control	60	0	0	675±183	0	20	11
Pu 1	30	100	0.63±0.06	727±100	3	8	6
Pu 2	31	500	2.66±0.43	580±117	7	8	2
Pu 3	32	1000	4.08±0.67	412± 84	16	2	0
Pu 4	31	5000	17.4±3.5	343± 87	12	3	0
Pu 5	30	10000	41.9±5.5	326± 68	4	4	0
<b>BC3</b>							
Control	60	0	0	746±162	0	21	32
Pu 1	31	100	0.63±0.06	730±107	8	7	7
Pu 2	33	500	2.62±0.37	567±115	17	5	2
Pu 3	33	1000	4.38±0.50	449± 64	12	2	0
Pu 4	32	5000	15.4±3.2	325±118	10	2	0
Pu 5	32	10000	41.5±7.9	322± 95	11	4	0

### 2.2.3 Injections of $^{239}\text{Pu}$ Citrate Solution into Mice for Hemopoietic Changes

**Purpose:** Time-course hemopoietic changes related directly or indirectly to lymphomyeloid neoplasms following injections of soluble  $^{239}\text{Pu}$  citrate solution into different strains of mice that are recognized to show different spectra of spontaneous or radiation-induced lymphomyeloid neoplasms.

**Animals:** Female adult C3H/HeN, C57BL/6J, and B6C3F<sub>1</sub> strains of mice, 90-110 days of age at the time of injections.

**Injections:** Single intraperitoneal injections of monomeric  $^{239}\text{Pu}$  citrate solution (pH 6.8 to 7.2) diluted with physiological saline into 5000 Bq/animal, an optimal dose for acute or subacute hemopoietic derangements and for induction of lymphoid neoplasms.

**Dosimetry:** The separate group of mice received 1000 Bq/animal of  $^{239}\text{Pu}$  citrate was sequentially sacrificed to measure the concentration of the retained activity in the ashed bones in a liquid scintillation spectrometer, resulting in the negatively exponential skeletal retention function. The cumulative mean skeletal dose for each animal until death was calculated by the time integral of the injected dose (Bq) and skeletal retention function.

**Endpoints:** Numbers of peripheral white blood cells, bone marrow and spleen cells, numbers of granulocyte-macrophage colony-forming cells (GM-CFC) in the bone marrow and the spleen during the period of one year after injections. As well, survival periods, causes of death, spectrum and distribution of tumors, particularly bone tumors and lymphoid neoplasms observed in dead or sacrificed animals.

#### Experimental Groups:

Total 6 groups from IP10 to IP11, each containing 10-20 injected and 10-15 age-matched, saline-injected (carrier) control animals as shown in **Table 12**.

**Table 12. Summary of Experimental Groups for Sequential Studies on Hemopoietic Changes in 3 Strains of Mice Following Injections of  $^{239}\text{Pu}$  citrate**

Group ID	Mouse Strain	Birth Date	Injection Date	Age (day) at Injection	No. of Pu-Injected	No. of Controls	Injected Dose (Bq)
IP10-1	C3H	9/11/97	12/19/97	98	20	15	5000
IP10-2	C3H	9/11/97	12/19/97	98	20	15	5000
IP10-3	C3H	9/11/97	12/19/97	98	20	15	5000
IP11-1	C3H	3/24/98	6/25/98	93	10	10	5000
IP11-2	C57	3/10/98	6/25/98	107	10	10	5000
IP11-3	BC3	3/24/98	6/25/98	93	10	10	5000

**Summary of Results:**

Four injected and two control animals from each strain were respectively sacrificed and examined for hematological changes at 30, 90, 180, 240, and 365 days after injections. The main findings are summarized as follows;

- 1) Peripheral white blood cells as well as bone marrow cells were persistently reduced in all the strains of mice from 90 days on, while spleen cells increased from 180 days on due to a compensatory extramedullary hemopoiesis.
- 2) Granulocyte-macrophage colony-forming cells (GM-CFC) were consistently reduced in the bone marrow but increased in the spleen from 90 days on.

**Publications:**

1. Oghiso, Y. and Yamada, Y. Strain differences in carcinogenesis and hematopoietic responses of mice after injection of plutonium citrate. *Radiat. Res.* **154**: 447-454, 2000.



#### 2.2.4 Injections of MNU into Mice for Lymphoid Neoplasms

**Purpose:** The carcinogenicity of an alkylating agent, N-methyl-N-nitrosourea (MNU) to induce lymphoid neoplasms in 3 different strains of mice, as compared to those following injections of  $^{239}\text{Pu}$  citrate.

**Animals:** Female adult C3H/HeN, C57BL/6J, and B6C3F<sub>1</sub> strains of mice, 90-100 days of age at the time of injections.

**Injections:** Five weekly intraperitoneal injections of 40 mg/kg body weight of MNU to achieve total 5-6 mg/animal, an optimal dose for induction of thymic lymphomas as described.

**Endpoints:** The frequency of lymphoid neoplasms and their histological and immunohistochemical phenotypes induced.

##### Experimental Groups:

Total 6 groups from MNU-1 to MNU-6, each containing 30 injected and 10 age-matched, saline-injected (carrier) control animals as shown in **Table 13**.

**Table 13. Summary of Experimental groups for Studies on Lymphoid Neoplasms in 3 Strains of Mice Following Injections of MNU**

Group ID	Mouse Strain	Birth Date	Period of Injection Date	Age (day) at Final Injection	No. of Injected	No. of Controls
MNU-1	C3H	7/18/00	9/18/00-10/17/00	91	30	10
MNU-2	C57	10/3/00	12/4/00-12/31/00	89	30	10
MNU-3	BC3	11/14/00	1/15/01-2/12/01	90	30	10
MNU-4	C3H	4/26/01	7/2/01-7/30/01	95	30	10
MNU-5	C57	5/28/01	8/6/01-9/3/01	98	30	10
MNU-6	BC3	9/17/01	11/26/01-12/25/01	99	30	10

##### Summary of Results:

The survival periods and lymphoid neoplasms induced in 3 strains of mice after injections of MNU were summarized in the next page (**Table 14**). The main findings are summarized as follows;

- 1) Lymphoid neoplasms, mostly T-lymphoblastic lymphomas, appeared very early after injections of MNU in all the strains of mice.
- 2) Interestingly, stomach squamous cell carcinomas were observed in a small yield (18%) of C3H mice.

**Table 14 Survival Period and Lymphoid Neoplasms Induced in 3 Strains of Mice  
Following Injections of MNU**

Mouse Strains	No. Animals	Survival (day)	No. of Lymphoid Neoplasms				No. Other Tumors
			All	T-cell	B-cell	Histiocytic	
C3H	60	106±64	20	18	2	0	11
C57	60	58±14	29	25	4	0	0
BC3	60	81±23	47	43	4	0	2

**Publications:**

1. Oghiso, Y. and Yamada, Y. Pre-B-cell lymphomas in mice following injection of <sup>239</sup>Pu citrate: Comparison with MNU-induced T-lymphoblastic lymphomas. J. Toxicol. Pathol. **16**: 93-102, 2003.

### 2.2.5 $\gamma$ -ray Irradiation of Mice for Carcinogenesis

**Purpose:** The lifetime risk and spectra of tumors, particularly lymphomyeloid neoplasms, specific to external low LET  $\gamma$ -ray irradiation in different strains of mice, as compared to those following injections of  $^{239}\text{Pu}$  citrate or MNU.

**Animals:** Female adult C3H/HeN, C57BL/6J, and B6C3F<sub>1</sub> strains of mice, 85-88 days of age at the time of irradiation.

**Irradiations:** Single whole-body  $\gamma$ -ray irradiation with a dose rate of 0.6 Gy/min using a sealed  $^{137}\text{Cs}$ -source to achieve total absorbed doses of 1.0 to 3.0 Gy.

**Dosimetry:** Dose measurement was carried out during all irradiation procedures with an ionization chamber in a conjunction with a thermoluminescent dosimeter. The average total accumulated doses measured were regarded as absorbed doses.

**Endpoints:** Survival periods, causes of death, spectrum and distribution of tumors observed, particularly lymphomyeloid neoplasms by histopathological examinations.

**Experimental Groups:**

Total 6 groups from  $\gamma$ -1 to  $\gamma$ -6, each containing 90 irradiated and 12 age-matched, unirradiated control animals as shown in **Table 15**.

**Table 15. Summary of Experimental Groups for Life-Span Studies on Carcinogenesis in 3 Strains of Mice Following  $\gamma$ -Irradiation**

Group Name	Mouse Strain	Birth Date	Irradiation Date	Age (day) at Irradiation	No. of Irradiated	No. of Controls	Total Dose (Gy)
$\gamma$ -1	C3H	9/27/01	12/21/01	85	90	12	1.0-3.0
$\gamma$ -2	C57	9/10/01	12/7/01	88	90	12	1.0-3.0
$\gamma$ -3	BC3	10/15/01	1/11/02	88	90	12	1.0-3.0
$\gamma$ -4	C3H	10/18/01	1/11/02	85	90	12	1.0-3.0
$\gamma$ -5	C57	11/12/01	2/8/02	88	90	12	1.0-3.0
$\gamma$ -6	BC3	12/18/01	3/15/02	87	90	12	1.0-3.0

**Summary of Results:**

Total 180 irradiated (60 each with total dose of 1.0, 2.0 and 3.0 Gy) and 24 control animals from each strain were kept under a barrier filtered air condition for postmortem pathological examinations on the survivals and tumors observed. The results on the survival periods and tumors of all the strains of mice are summarized in the next page (**Table 16**). In addition, non-neoplastic lesions from the control and  $\gamma$ -irradiated mice were examined, and the temporarily distributed mostly in the liver and kidneys, and rarely in the pancreas, spleen, heart or lung. Any specific relations of these non-neoplastic lesions to doses or strain differences in the appearance were not found.

**Table 16. Survival Period and Tumor Induction in 3 Strains of Mice Following  $\gamma$ -Irradiation**

Group Name	Dose (Gy)	Total No. Animals	No. Dead Animals	Survival (day)	No. of Tumor-Bearers		
					Lymphoid	Myeloid	Others
<u>C3H</u>							
Control	0	24	24	786 $\pm$ 72	2	0	4
1	1.0	60	60	721 $\pm$ 95	2	0	39
2	2.0	60	60	675 $\pm$ 101	0	0	29
3	3.0	60	60	591 $\pm$ 137	6	0	36
<u>C57</u>							
Control	0	24	24	739 $\pm$ 137	6	2	5
1	1.0	60	60	711 $\pm$ 119	12	2	21
2	2.0	60	59	702 $\pm$ 123	13	2	17
3	3.0	60	60	614 $\pm$ 160	18	4	13
<u>BC3</u>							
Control	0	24	24	857 $\pm$ 149	12	1	10
1	1.0	60	60	716 $\pm$ 145	15	3	44
2	2.0	60	60	659 $\pm$ 155	18	2	50
3	3.0	60	60	609 $\pm$ 153	11	1	47

### 3. Summary of Pathological Findings on Individual Animals from Each Experimental Group

#### 3.1 Pulmonary Carcinogenesis in Rats

The experimental groups for lifetime risk evaluation on pulmonary carcinogenesis in female Wistar rats following either inhalation exposures to  $^{239}\text{PuO}_2$  aerosols or both of whole-body and thoracic X-irradiation are the objects for summarization of pathological findings, mainly histopathology of primary lung tumors as well as the other incidental tumors including metastasis, on individual animals which were only available for postmortem pathological examinations without cannibalism and autolysis of lungs. Information on the experimental regimens is also attached to each table list on pathological findings.

##### 3.1.1 Experimental Groups for Inhalation Exposures to $^{239}\text{Pu}$ Dioxide Aerosols Groups of Control Animals

The control groups of unexposed animals as listed below correspond to each of experimental groups of exposed animals (Groups C to Y), respectively.

##### Control Groups

Animal ID	Survival (day)	Histopathology	
		Lung Tumors	Other Tumors
C1	730	meta.adenocarcinoma meta.hemangiosarcoma	Mam.adenocarcinoma  Mam.fibroadenoma Ov. adenocarcinoma Liv. hemangiosarcoma
C2	821		
C3	889		
C4	944		
C5	950		
C6	1012		
C7	1026		
C8	1069		
C9	1152		
D1	622		Cholangiocarcinoma/Mam.F  Mam.adenoma
D2	703		
D3	890		
D4	895		
D5	897		
D6	907		
D7	941		
D8	986		
D9	1012		
D10	1116		
E1	721		Adr.pheochromocytoma
E2	765		
E3	792		
E4	800		
E5	820		
E6	824		
E7	830		
E8	846		
E9	854		
E10	881		
E11	927		

### Control Groups (Cont'd)

Animal ID	Survival (day)	Histopathology	
		Lung Tumors	Other Tumors
F1	603	meta.adenocarcinoma	
F2	774		
F3	783		
F4	836		Mam.fibroma
F5	837		Mam.fibroma
F6	863		
F7	889		Mam.adenocarcinoma
F8	898		
F9	927		
F10	931		
F11	974		
G1	643	Squamous cell Ca meta.lymphoma	Mam.fibroma
G2	759		
G3	777		Leukemic lymphoma
G4	810		Mam.adenoma
G5	858		
G6	860		
G7	887		Mam.fibrosarcoma
G8	888		
G9	946		
G10	989		
H1	601		
H2	692		
H3	714		
H4	759		
H5	782		
H6	788		
H7	864		
H8	868		
H9	933		
H10	999		
I1	943		Mam.adenoma
I2	997		Mam.fibroma
I3	1030		
I4	1051		Mam.adenoma
I5	1052		Cholangioadenocarcinoma
I6	1060		Mam.adenoma/Ov.carcinoma
I7	1060		Mam.fibroma
I8	1067		Mam.fibroma
I9	1070		Mam.fibroma
I10	1090		
K1	612	meta.carcinoma	
K2	635		
K3	923		Mam.fibroma
K4	950		Ov.carcinoma
K5	1006		
K6	1009		Mam.adenoma
K7	1025		
K8	1087		
K9	1109		
K10	1200		Mam.adenoma

### Control Groups (Cont'd)

Animal ID	Survival (day)	Histopathology	
		Lung Tumors	Other Tumors
M1	458	Adenoma	Mam.adenoma  Mam.adenocarcinoma Mam.fibroadenoma        Ut.leiomyosarcoma  Mam.fibroma Ov.carcinoma/Mam.fibroma Mam.fibroma Mam.fibroma
M2	719		
M3	732		
M4	751		
M5	829		
M6	864		
M7	865		
M8	915		
M9	919		
M10	938		
M11	1012		
M12	1017		
M13	1025		
M14	1042		
M15	1051		
M16	1058		
M17	1063		
M18	1078		
M19	1098		
M20	1111		
N1	674	meta.leukemia	Mam.adenoma  Leukemia  Mam.adenocarcinoma
N2	731		
N3	736		
N4	852		
N5	894		
N6	949		
N7	1025		
N8	1051		
N9	1052		
N10	1164		
P1	756		Mam.fibrosarcoma    Mam.adenocarcinoma Mam.fibroma
P2	801		
P3	879		
P4	886		
P5	910		
P6	915		
P7	1030		
P8	1039		
P9	1082		
Q1	755		Mam.fibroma      Mam.adenoma
Q2	769		
Q3	837		
Q4	845		
Q5	907		
Q6	969		
Q7	987		
Q8	1103		
Q9	1138		
Q10	1194		



### Control Groups (Cont'd)

Animal ID	Survival (day)	Histopathology	
		Lung Tumors	Other Tumors
R1	650	Adenoma	Ov.carcinoma
R2	776		
R3	869		
R4	871		Mam.fibroma
R5	905		Mam.fibroma
R6	942		Mam.adenoma
R7	1041		
R8	1049		
R9	1101		
R10	1151		
S1	725		
S2	747		
S3	842		
S4	878		
S5	925		
S6	969		Mam.adenoma
S7	979		
S8	1030		
S9	1096		
T1	719		
T2	829		
T3	867		Ur.Bl.carcinoma
T4	938		meta.Ov.carcinoma
T5	974		
T6	979		
T7	1002		Mam.fibroadenoma
T8	1062		
T9	1096		
T10	1154		
V1	632		
V2	763		Ov.carcinoma
V3	806		
V4	867		
V5	923		
V6	944		
V7	990		
V8	1058		Mam.fibroma
V9	1112		
V10	1149		Ov.fibrosarcoma/Mam.ad.
W1	625	Adenoma	
W2	668		
W3	689		Ov.adenocarcinoma
W4	767		
W5	845		
W6	853		
W7	923		
W8	976		
W9	996		
W10	1056		Mam.adenoma

### Control Groups (Cont'd)

Animal ID	Survival (day)	Histopathology	
		Lung Tumors	Other Tumors
X1	892		Ov.adenocarcinoma
X2	945		
X3	1014		
X4	1020		
X5	1048		
X6	1135		
X7	1152		
Y1	728	meta.adenocarcinoma meta.adenocarcinoma         meta.adenocarcinoma	Mam.fibrosarcoma
Y2	731		meta.Ov.adenocarcinoma
Y3	805		meta.Mam.adenocarcinoma
Y4	829		
Y5	833		
Y6	868		
Y7	868		
Y8	873		
Y9	919		
Y10	929		meta.Mam.adenocarcinoma
Y11	933		
Y12	946		
Y13	947		
Y14	981		
Y15	993		
Y16	1063		Mam.adenoma
Y17	1076		
Y18	1084		Mam.fibroma
Y19	1114		
Y20	1169		Ur.Bl.Ca/Mam.adenoma

### Groups of Exposed Animals

The experimental groups of  $^{239}\text{PuO}_2$ -exposed animals as listed below include the Groups A to Z, and A' to C', and the information on the experimental regimens including the age of animals at inhalation exposures and AMAD with GSD of the  $^{239}\text{PuO}_2$  aerosols, is attached to the head of the table for each group, respectively.

#### Group A

[Age at exposures: 84 days/AMAD: 0.47/GSD: 2.1]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
A-1	2363	350	12.7	Adenomatous metaplasia	Mam.fibroadenoma
A-2	2281	210	10.3	Adenomatous metaplasia	
A-5	1673	210	7.6	adenomatous metaplasia	
A-6	2410	135	9.2		
A-10	3229	135	12.4		
A-3	1802	515	11.1	Undifferentiated carcinoma	
A-8	2433	557	15.4	Adenocarcinoma	
A-9	2328	562	14.8	Squamous cell carcinoma	
A-7	3065	630	20.3	Adenosquamous carcinoma	

### Group C

[Age at exposures: 99 days/AMAD: 0.44/GSD: 2.0]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
C-1-1-1	905	494	5.19	Adenoma	SC fibroma
C-2-2-1	817	514	4.77	Squamous cell carcinoma	
C-2-2-2	796	529	4.69	Adenoma	
C-1-1-2	817	568	4.96	Adenocarcinoma	
C-1-2-1	1003	597	6.19	Squamous cell carcinoma	
C-2-2-3	774	613	4.84	Adenocarcinoma	
C-2-2-4	730	643	4.65	Adenocarcinoma	
C-1-2-2	970	673	6.29	Adenocarcinoma	
C-1-2-3	905	679	5.89	Adenocarcinoma	
C-1-2-4	828	706	5.47	Adenoma	
C-2-2-5	512	736	3.44	Adenoma	
C-1-1-3	719	742	4.84	Adenosquamous carcinoma	
C-1-1-4	687	761	4.67	Adenosquamous carcinoma	
C-2-1-1	98	771	0.67	Adenoma	Mam.fibroma
C-2-1-2	88	825	0.61		

### Group D

[Age at exposures: 96 days/AMAD: 0.40/GSD: 1.9]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
D-1-1-1	1208	250	5.53	Adenocarcinoma	Salivary gl.adenoma  Ov. adenocarcinoma  Mam.adenoma
D-2-1-1	1273	372	6.68	Adenosquamous carcinoma	
D-1-2-1	1204	420	6.61	Undifferentiated carcinoma	
D-2-1-2	1182	450	6.66	Adenocarcinoma	
D-1-1-2	1155	513	6.85	Adenosquamous carcinoma	
D-2-2-1	1227	543	7.44	Adenosquamous carcinoma	
D-2-2-2	1057	543	6.41	Adenosquamous carcinoma	
D-1-2-2	1151	565	7.08	Adenosquamous carcinoma	
D-1-2-3	1055	573	6.53	Adenosquamous carcinoma	
D-2-1-3	1111	575	6.88	Adenosquamous carcinoma	
D-2-1-4	989	576	6.12	Adenoma	
D-2-2-3	1052	580	6.53	Adenosquamous carcinoma	
D-2-2-4	961	584	5.99	Adenosquamous carcinoma	
D-1-1-4	1037	585	6.46	Adenocarcinoma	
D-1-2-4	1032	593	6.47	Adenosquamous carcinoma	
D-1-1-5	976	594	6.12	Adenocarcinoma	
D-1-2-5	985	635	6.34	Adenosquamous carcinoma	
D-2-1-5	928	656	6.04	Adenosquamous carcinoma	
D-2-2-5	626	725	4.24	Adenocarcinoma	

### Group E

[Age at exposures: 108 days/AMAD: 0.43/GSD: 2.0]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
E-2-2-1	1883	363	9.31	Adenocarcinoma	Mam.fibroadenoma
E-1-2-1	1840	418	9.60	Adenocarcinoma	
E-2-1-1	1658	450	8.89	Adenosquamous carcinoma	
E-1-2-2	1669	456	8.98	Adenosquamous carcinoma	
E-2-2-2	1519	468	8.28	Adenosquamous carcinoma	
E-1-2-3	1476	475	8.08	Adenosquamous carcinoma	
E-2-1-2	1605	475	8.79	Adenosquamous carcinoma	
E-1-2-4	1241	489	6.88	Adenosquamous carcinoma	
E-1-1-2	1444	499	8.07	Adenoma	
E-2-1-3	1551	510	8.74	Adenosquamous carcinoma	
E-2-1-4	1541	520	8.75	Adenocarcinoma	
E-1-1-4	1327	544	7.67	Adenocarcinoma	
E-2-2-3	1369	577	8.10	Adenosquamous carcinoma	
E-2-2-4	867	608	5.25	Adenocarcinoma	
E-2-1-5	1188	609	7.19	Adenocarcinoma	Mam.fibroadenoma
E-2-2-5	727	656	4.54	Adenosquamous carcinoma	Mam.fibroma
E-1-1-5	1102	656	6.87	Squamous cell carcinoma	
E-1-2-5	695	751	4.58	Adenosquamous carcinoma	

### Group F

[Age at exposures: 130 days/AMAD: 0.44/GSD: 2.0]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
F-2-1-1	1436	457	7.32	Hemangiosarcoma	
F-2-2-1	1285	465	6.61		
F-2-2-2	1263	466	6.50	Adenocarcinoma	
F-2-2-3	1231	486	6.44	Adenosquamous carcinoma	
F-2-1-2	1307	487	6.84	Squamous cell carcinoma	
F-2-2-4	1231	495	6.50	Adenocarcinoma	
F-1-2-2	1274	502	6.75		
F-1-2-3	1004	527	5.43	Adenosquamous carcinoma	
F-1-1-1	1458	528	7.92	Adenosquamous carcinoma	
F-1-1-2	1307	531	7.10	Adenocarcinoma	
F-1-1-3	1274	546	7.01	Adenocarcinoma	
F-1-1-4	1263	557	7.00	Adenosquamous carcinoma	
F-2-2-5	1231	557	6.82	Adenosquamous carcinoma	
F-2-1-3	1231	581	6.95	Adenocarcinoma	
F-2-1-4	1123	581	6.34	Adenosquamous carcinoma	
F-1-1-5	950	595	5.42	Adenoma	
F-2-1-5	831	612	4.80	Adenosquamous carcinoma	
F-1-2-4	885	623	5.16	Adenosquamous carcinoma	
F-1-2-5	637	661	3.80	Adenocarcinoma	

### **Group G**

[Age at exposures: 157 days/AMAD: 0.43/GSD: 1.9]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
G-1-1-1	1979	343	8.49	Adenocarcinoma	Urin.Bl.fibrosarcoma
G-2-1-1	2322	392	10.5	Adenosquamous carcinoma	
G-2-1-2	1990	399	9.09	Adenosquamous carcinoma	
G-2-2-1	2204	428	10.4	Adenocarcinoma	
G-1-1-2	1872	437	8.87		
G-1-1-3	1840	444	8.80	Adenosquamous carcinoma	
G-1-2-5	2279	446	10.9	Adenocarcinoma	
G-2-2-2	1990	449	9.57	Adenocarcinoma	
G-2-2-3	1872	450	9.00	Adenocarcinoma	
G-1-1-4	1819	469	8.91	Squamous cell carcinoma	
G-2-2-4	1872	477	9.22	Adenocarcinoma	
G-2-1-3	1862	482	9.21	Adenocarcinoma	
G-2-2-5	1658	512	8.42	Adenocarcinoma	
G-2-1-4	1637	526	8.42	Adenosquamous carcinoma	
G-1-1-5	1498	526	7.71	Adenosquamous carcinoma	
G-2-1-5	963	600	5.22	Squamous cell carcinoma	

### **Group H**

[Age at exposures: 145 days/AMAD: 0.30/GSD: 2.0]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
H-2-1-1	972	465	4.83	Adenosquamous carcinoma	Mam.fibroma
H-1-2-1	918	541	4.87	Adenoma	
H-1-2-2	831	552	4.45	Adenoma	
H-1-1-1	1058	572	5.75	Adenosquamous carcinoma	
H-2-2-1	939	586	5.16	Adenocarcinoma	Mam.fibroma
H-2-2-2	929	586	5.11	Squamous cell carcinoma	
H-1-1-2	896	618	5.05	Adenoma	
H-1-2-3	810	627	4.58	Adenosquamous carcinoma	
H-2-1-2	939	627	5.31	Adenosquamous carcinoma	Uterus fibrosarcoma
H-1-2-4	756	628	4.29	Adenocarcinoma	
H-1-1-3	885	657	5.11	Adenosquamous carcinoma	
H-2-1-3	885	671	5.16	Adenosquamous carcinoma	
H-1-1-4	756	680	4.44	Adenocarcinoma	Uterus fibrosarcoma
H-2-1-4	821	694	4.87	Adenocarcinoma	
H-1-2-5	756	705	4.51	Adenosquamous carcinoma	
H-2-2-4	885	725	5.35	Adenosquamous carcinoma	
H-1-1-5	713	758	4.40	Squamous cell carcinoma	
H-2-2-5	756	766	4.68	Adenosquamous carcinoma	
H-2-1-5	702	776	4.37	Adenosquamous carcinoma	

### Group I

[Age at exposures: 153 days/AMAD: 0.44/GSD: 2.0]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
I-2-1-1	993	301	4.01		
I-2-4-1	1037	475	5.10	Adenocarcinoma	
I-1-2-1	1080	517	5.51	Adenosquamous carcinoma	Mam. fibroadenoma
I-1-4-1	972	519	4.98	Adenocarcinoma	
I-2-3-1	993	570	5.30	Adenosquamous carcinoma	
I-1-1-1	983	581	5.33	Squamous cell carcinoma	
I-2-4-2	918	581	4.98	Adenocarcinoma	
I-1-4-2	853	590	4.66	Adenoma	Mam. fibroadenoma
I-1-1-2	929	607	5.14		Mam. fibroadenoma
I-2-1-2	896	608	4.97		Mam. fibroma
I-2-1-3	734	636	4.15	Squamous cell carcinoma	
I-1-1-3	821	662	4.72	Squamous cell carcinoma	
I-1-2-2	983	671	5.69	Adenocarcinoma	
I-1-3-1	993	671	5.75	Adenocarcinoma	SC fibrosarcoma
I-2-2-2	885	672	5.12	Squamous cell carcinoma	Mam. fibroadenoma
I-2-2-3	821	681	4.78	Adenocarcinoma	
I-1-2-3	983	700	5.80	Adenocarcinoma	Renal carcinoma
I-2-1-4	680	704	4.02	Adenoma	
I-1-4-3	842	708	5.00	Adenomatous metaplasia	
I-2-4-3	799	724	4.79	Squamous cell carcinoma	
I-2-1-5	605	731	3.64	Adenocarcinoma	
I-1-2-4	907	732	5.45	Adenocarcinoma	
I-1-4-4	767	732	4.61		Urinary bladder tumor
I-1-3-2	972	763	5.97	Adenocarcinoma	Mam. fibroma
I-1-2-5	756	771	4.65	Adenocarcinoma	Mam. fibroma
I-1-1-4	615	783	3.82	Adenocarcinoma	
I-1-3-3	907	785	5.63	Adenocarcinoma	
I-1-4-5	767	787	4.76	Adenocarcinoma	Mam. fibroma
I-2-2-4	799	791	4.97	Adenosquamous carcinoma	
I-1-1-5	129	802	0.75		
I-2-4-4	734	803	4.61	Adenoma	
I-1-3-4	831	805	5.22	Adenosquamous carcinoma	
I-1-3-5	659	808	4.15	Adenosquamous carcinoma	Mam. fibroma
I-2-3-3	983	816	6.21	Adenocarcinoma	
I-2-3-4	691	816	4.36	Adenosquamous carcinoma	
I-2-2-5	745	856	4.80	Adenoma	
I-2-4-5	18	880	0.12		
I-2-3-5	104	1006	0.72	Adenoma	Mam. adenoma

### **Group K**

[Age at exposures: 92 days/AMAD: 0.41/GSD: 2.0]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
K-2-3-1	219	540	1.34		Mam. adenoma
K-2-4-1	180	550	1.11		
K-1-3-1	262	558	1.63	Adenocarcinoma	Mam. fibroadenoma
K-1-4-1	278	570	1.74	Adenoma	
K-2-2-1	162	573	1.02		Mam. fibroma
K-1-1-1	270	583	1.71		Mam. fibroadenoma
K-1-4-2	213	606	1.37		
K-2-1-1	145	607	0.93		
K-2-2-2	159	617	1.03		Adrenal adenoma
K-1-4-3	205	637	1.34	Adenoma	
K-2-3-2	180	700	1.22		
K-1-1-2	262	703	1.78	Adenoma	M.F./Ov. granulosa T.
K-1-1-3	259	722	1.78	Adenocarcinoma	Mam. fibroadenoma
K-2-4-2	180	722	1.23	Adenoma	Mam. fibroma
K-1-4-4	167	727	1.15	Adenocarcinoma	
K-2-3-3	153	734	1.06		
K-1-4-5	163	755	1.12		
K-1-2-1	257	759	1.80		
K-2-4-3	157	782	1.11		Mam. fibroma
K-2-3-4	135	795	0.96		
K-2-2-3	143	801	1.02	Adenoma	
K-2-1-2	129	818	0.93		Mam. fibroma
K-2-2-4	119	818	0.86	Adenoma	
K-1-3-2	259	839	1.89	Adenoma	
K-1-3-3	204	862	1.50		Mam. adenocarcinoma
K-2-1-3	112	866	0.82		
K-1-2-2	232	874	1.72	Adenoma	Mam. fibroadenoma
K-1-3-4	132	889	0.98	Adenoma	
K-2-4-4	126	894	0.94	Adenoma	SC. fibroma
K-1-2-3	202	933	1.53		
K-2-2-5	75	946	0.57	Adenocarcinoma	Mam. fibroadenoma
K-2-1-4	107	948	0.82		Mam. fibroma
K-1-1-4	238	951	1.82	Adenocarcinoma	Mam. fibroadenoma
K-2-3-5	92	952	0.70		Mam. fibroadenoma
K-2-4-5	35	958	0.27	Adenoma	
K-1-2-4	201	974	1.55	Adenocarcinoma	Mam. fibroma
K-2-1-5	64	976	0.49	Adenocarcinoma	
K-1-1-5	237	1010	1.85	Adenocarcinoma	
K-1-2-5	195	1044	1.52	Adenocarcinoma	M.F./Thyroid AC
K-1-3-5	64	1069	0.50	Adenoma	M.F./Uterus AC



### Group M

[Age at exposures: 81 days/AMAD: 0.27/GSD: 2.2]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
M-3-1	110	676	0.76	Adenoma	
M-3-2	108	747	0.78		SC fibroma
M-2-1	121	777	0.88		Mam.fibroadenoma
M-4-1	101	782	0.74		Mam.fibroadenoma
M-1-2	104	785	0.76		
M-2-2	114	821	0.85	Adenocarcinoma	Mam.adenoma
M-3-3	91	834	0.68		Mam.fibroma
M-1-3	103	855	0.78		SC lipoma
M-4-2	85	857	0.64		Mam.adenoma
M-2-3	106	859	0.80		Mam.adenoma
M-4-3	85	897	0.65	Adenoma	Mam.fibroma
M-4-4	69	903	0.53		Mam.fibroma
M-1-4	99	904	0.76	Adenoma	
M-2-4	88	913	0.68		Mam.AD/Lymphoma
M-2-5	82	923	0.64		
M-3-4	87	928	0.68		
M-3-5	83	975	0.66	Adenoma	Ov. cystadenoma
M-1-5	89	997	0.71		
M-4-5	57	1011	0.46	Adenoma	

### Group N

[Age at exposures: 92 days/AMAD: 0.37/GSD: 1.8]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
N-4-1	240	452	1.38	Adenoma	
N-8-1	277	526	1.68		met.Abdominal tumor
N-4-2	219	532	1.34	Adenocarcinoma	Mam.fibroadenoma
N-8-2	274	601	1.73		met.Bile duct carcinoma
N-1-1	243	610	1.56		Thoratic tumor
N-5-1	288	616	1.86	Adenoma	
N-4-3	210	636	1.37	Adenosquamous carcinoma	Mam.fibroma
N-8-3	246	656	1.63	Adenoma	
N-6-1	289	667	1.96		
N-8-4	236	683	1.59		SC fibrosarcoma
N-3-1	255	686	1.72	Adenocarcinoma	
N-2-1	202	725	1.39	Adenoma	Mam.adenoma
N-2-2	170	730	1.17	Adenosquamous carcinoma	Mam.fibroma
N-5-2	231	739	1.60	Adenoma	Ov.adenocarcinoma
N-6-2	264	755	1.84	Adenocarcinoma	
N-5-3	195	756	1.36	Adenocarcinoma	Ov.adenocarcinoma
N-2-3	168	757	1.17		meta.fibroadenocarcinoma
N-3-2	241	761	1.69	Adenoma	Mam.tumor
N-3-3	215	764	1.51	Adenocarcinoma	Ov.adenocarcinoma
N-5-4	175	772	1.23	Adenoma	Ov.adenocarcinoma
N-6-3	247	791	1.76	Adenoma	Ov.adenocarcinoma
N-2-4	160	809	1.15	Adenocarcinoma	Ov.adenocarcinoma
N-6-4	224	809	1.61	Adenosquamous carcinoma	
N-7-1	253	831	1.83	Adenoma	
N-4-4	107	844	0.78		Mam.T/Thoratic sarcoma
N-3-4	213	870	1.57	Adenosquamous carcinoma	Mam.tumor
N-7-2	251	882	1.86	Adenocarcinoma	Mam.tumor
N-2-5	134	883	0.99		Submand.fibrosarcoma
N-7-3	249	891	1.85	Adenocarcinoma	
N-8-5	101	897	0.75	Adenoma	Thyroid med.carcinoma
N-6-5	175	903	1.31	Adenocarcinoma	
N-7-4	214	919	1.61	Adenocarcinoma	Ov.adenocarcinoma
N-1-2	209	933	1.59		
N-3-5	190	947	1.43	Adenocarcinoma	
N-7-5	207	953	1.58	Adenoma	Mam.tumor
N-1-3	200	969	1.54	Adenoma	Mam.tumor
N-1-4	148	970	1.14	Adenocarcinoma	
N-1-5	110	1002	0.86	Adenocarcinoma	Mam.fibroma
N-5-5	122	1002	0.95	Adenoma	SC fibroma

### Group P

[Age at exposures: 87 days/AMAD: 0.46/GSD: 2.0]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
P-1-3-1	694	328	3.65	Adenocarcinoma	
P-1-3-2	651	330	3.42		
P-1-2-1	527	355	2.84		
P-1-1-1	517	463	3.06		
P-1-1-2	474	601	3.09	Adenoma	
P-1-3-3	507	618	3.34	Adenocarcinoma	
P-1-1-3	462	680	3.15	Adenosquamous carcinoma	
P-1-4-1	546	683	3.74	Adenosquamous carcinoma	
P-1-2-2	512	685	3.51	Adenoma	
P-1-4-2	527	695	3.63	Adenocarcinoma	Mam.fibroma
P-1-4-3	442	701	3.05	Adenocarcinoma	Mam.adenoma
P-1-3-4	483	701	3.34	Adenocarcinoma	
P-1-3-5	252	731	1.77	Adenocarcinoma	Mam.tumor
P-1-2-3	452	746	3.20	Adenocarcinoma	
P-1-1-4	361	757	2.56	Adenocarcinoma	
P-1-2-4	401	768	2.87	Adenocarcinoma	
P-1-4-4	381	826	2.80		
P-1-1-5	324	843	2.40	Adenocarcinoma	
P-1-4-5	350	879	2.64	Adenoma	
P-1-2-5	399	935	3.07	Adenocarcinoma	

### Group Q

[Age at exposures: 107 days/AMAD: 0.39/GSD: 2.1]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
Q-1-1-1	430	406	2.25		Abd.liposarcoma
Q-1-2-1	461	424	2.45	Adenoma	
Q-1-3-1	550	495	3.11	Adenoma	
Q-1-4-1	538	523	3.11	Adenocarcinoma	
Q-1-4-2	448	533	2.61	Adenocarcinoma	
Q-1-4-3	404	561	2.40	Adenocarcinoma	
Q-1-3-2	483	591	2.93	Adenocarcinoma	
Q-1-2-2	459	594	2.79	Adenocarcinoma	
Q-1-3-3	405	622	2.50	Adenosquamous carcinoma	
Q-1-3-4	394	650	2.48	Squamous cell carcinoma	
Q-1-2-3	427	682	2.75	Adenocarcinoma	
Q-1-1-2	415	702	2.69	Adenoma	
Q-1-1-3	412	715	2.70	Adenocarcinoma	
Q-1-2-4	382	741	2.57	Adenosquamous carcinoma	Ov.adenocarcinoma
Q-1-4-4	368	761	2.47	Adenoma	Mam.tumor
Q-1-4-5	360	770	2.43	Adenoma	
Q-1-3-5	357	783	2.43	Adenocarcinoma	
Q-1-1-4	411	809	2.83	Adenocarcinoma	Mam.tumor
Q-1-2-5	320	827	2.22	Adenoma	
Q-1-1-5	350	892	2.50	Adenosquamous carcinoma	

### Group R

[Age at exposures: 87 days/AMAD: 0.43/GSD: 2.1]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
R-1-4-1	348	354	1.87		
R-1-2-1	329	443	1.92		
R-1-2-2	312	535	1.95	Adenoma	Ov.adenocarcinoma
R-1-2-3	307	638	2.05		Mam.tumor
R-1-1-1	317	687	2.17		
R-1-3-2	383	689	2.63		Mam.tumor
R-1-1-2	263	689	1.81	Adenocarcinoma	
R-1-3-3	312	700	2.15	Adenocarcinoma	
R-1-2-4	294	783	2.12	Adenoma	Monocytic leukemia
R-1-4-2	321	824	2.36	Adenocarcinoma	Mam.tumor
R-1-3-4	303	836	2.24	Adenoma	Ov.adenocarcinoma
R-1-3-5	271	889	2.05	Adenocarcinoma	
R-1-1-3	247	901	1.88		
R-1-1-4	240	913	1.83	Adenocarcinoma	
R-1-4-3	315	970	2.46	Adenocarcinoma	Mam.fibroadenoma
R-1-4-4	283	975	2.21	Adenoma	
R-1-4-5	199	986	1.56		meta.Ov.adenocarcinoma
R-1-2-5	262	993	2.07	Adenosquamous carcinoma	
R-1-1-5	182	1010	1.44	Adenocarcinoma	Mam.tumor

### Group S

[Age at exposures: 74 days/AMAD: 0.46/GSD: 2.1]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
S-2-4-1	147	29	0.24		
S-1-3-1	605	320	3.22	Adenocarcinoma	
S-1-1-1	491	436	2.90	Squamous cell carcinoma	
S-1-2-1	449	450	2.69		
S-2-4-2	169	491	1.04		
S-1-1-2	395	497	2.44	Adenocarcinoma	meta.Ov.fibroadenocarc.
S-2-3-1	167	528	1.06		
S-1-4-1	503	536	3.20		
S-1-4-2	448	540	2.86		
S-2-2-1	172	554	1.11		Mam.tumor
S-1-2-2	397	592	2.62		
S-2-1-1	216	605	1.44	Adenocarcinoma	Mam.adenocarcinoma
S-2-1-2	180	661	1.24		
S-2-2-2	161	661	1.11		meta.Ov.adenocarcinoma
S-1-3-2	450	665	3.10	Adenosquamous carcinoma	
S-1-3-3	437	692	3.06	Adenocarcinoma	
S-1-4-3	433	714	3.07	Squamous cell carcinoma	
S-1-4-4	379	717	2.69	Adenocarcinoma	
S-2-1-3	170	721	1.21		Mam.fibroadenoma
S-1-4-5	358	728	2.56	Adenosquamous carcinoma	
S-1-1-3	395	748	2.85	Adenocarcinoma	Mam.fibroadenoma
S-1-2-3	394	748	2.84	Adenoma	
S-2-2-3	153	751	1.10	Adenoma	Mam.fibroma
S-1-3-4	421	779	3.08	Adenocarcinoma	Mam.fibroma
S-1-2-4	344	783	2.52	Adenocarcinoma	Mam.fibroma
S-2-4-3	139	803	1.03	Adenoma	
S-1-3-5	354	804	2.62	Adenocarcinoma	
S-1-1-4	382	815	2.84	Adenocarcinoma	Mam.tumor
S-1-2-5	332	835	2.49	Adenocarcinoma	
S-2-3-2	167	845	1.26	Adenocarcinoma	
S-2-2-4	146	864	1.11		Urin.Bl.fibrosarcoma
S-2-4-4	133	887	1.02	Adenoma	Mam.fibroadenoma
S-2-3-3	141	889	1.08	Adenocarcinoma	Urin.Bl.tumor
S-2-1-4	147	895	1.13	Adenocarcinoma	Ov.tumor
S-1-1-5	335	904	2.59	Adenocarcinoma	
S-2-1-5	110	920	0.86	Adenocarcinoma	Mam.tumor
S-2-2-5	141	923	1.10	Adenoma	
S-2-3-4	136	977	1.08	Adenoma	Mam.adenoma
S-2-3-5	120	1040	0.96	Adenocarcinoma	
S-2-4-5	100	1040	0.80	Adenocarcinoma	

### **Group T**

[Age at exposures: 95 days/AMAD: 0.37/GSD: 2.0]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
T-1-3-1	231	183	0.95		meta.Osteosarcoma
T-2-3-1	58	279	0.27		
T-1-4-1	437	419	2.40	Adenoma	
T-1-4-2	383	446	2.15		
T-1-4-3	326	447	1.83		
T-1-1-1	311	458	1.77		Ov.adenocarcinoma
T-1-4-4	246	537	1.48		Ov.adenocarcinoma
T-2-4-1	43	558	0.26		
T-1-3-2	364	575	2.25	Adenoma	Ov.adenocarcinoma
T-2-3-2	43	625	0.27	Adenoma	
T-2-2-1	45	671	0.29		Ov.AC/Mam.FA
T-2-4-2	40	680	0.26		Mam.adenoma
T-1-3-3	317	693	2.11	Adenoma	
T-2-3-3	40	705	0.27	Adenoma	
T-2-3-4	39	734	0.26		
T-1-3-4	262	747	1.80	Squamous cell carcinoma	
T-2-1-1	57	751	0.39		Ov.adenocarcinoma
T-2-1-2	42	755	0.29		Mam.tumor
T-2-1-3	32	756	0.22		
T-1-3-5	235	761	1.62	Adenoma	
T-2-2-2	42	768	0.29		
T-1-1-3	302	769	2.09		meta,Ov.adenocarcinoma
T-1-2-1	310	801	2.18	Adenocarcinoma	SC fibrosarcoma
T-2-4-3	39	802	0.27		Ov.tumor/Mam.tumor
T-2-2-3	39	813	0.27		
T-2-2-4	35	815	0.25	Adenoma	
T-1-1-4	289	824	2.06	Adenocarcinoma	Mam.fibroadenoma
T-1-2-2	305	830	2.18	Adenoma	Ov.adenocarcinoma
T-2-2-5	30	834	0.21	Adenoma	
T-1-2-3	290	835	2.08	Adenocarcinoma	
T-1-2-4	256	841	1.84	Adenoma	Mam.tumor
T-1-2-5	236	844	1.70	Adenoma	Mam.fibroma
T-1-4-5	123	850	0.89	Adenoma	
T-2-1-4	30	858	0.22	Adenoma	
T-1-1-5	258	874	1.88	Adenocarcinoma	
T-2-1-5	28	920	0.21	Adenoma	Mam.tumor
T-2-4-4	33	971	0.25	Adenoma	Mam.fibroadenoma
T-2-3-5	27	1001	0.21	Adenoma	Ov.adenosarcoma
T-2-4-5	26	1078	0.20	Adenoma	Ov.adenocarcinoma

### Group V

[Age at exposures: 87 days/AMAD: 0.33/GSD: 2.4]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
V-3-2-1	325	345	1.73		
V-3-1-1	292	418	1.63		
V-3-2-2	283	426	1.59		
V-3-4-2	257	518	1.56	Adenocarcinoma	
V-3-1-2	290	642	1.90		
V-3-1-3	283	665	1.88	Adenocarcinoma	
V-3-4-3	253	676	1.69	Adenoma	Mam.fibroma
V-3-1-4	280	746	1.95	Adenocarcinoma	
V-3-4-4	250	752	1.74	Adenocarcinoma	
V-3-3-1	280	763	1.97	Adenocarcinoma	
V-3-3-2	275	767	1.93	Adenocarcinoma	
V-3-3-3	275	807	1.97	Squamous cell carcinoma	
V-3-3-4	238	810	1.71	Adenocarcinoma	Mam.tumor/Ov.tumor
V-3-4-5	237	892	1.77	Adenocarcinoma	Ov.sarcoma
V-3-2-3	266	894	1.98	Adenoma	
V-3-2-4	232	925	1.75	Adenocarcinoma	Mam.tumor
V-3-2-5	49	926	0.37	Adenoma	Hepatic adenoma
V-3-3-5	234	939	1.78	Adenoma	Mam.tumor
V-3-1-5	243	998	1.89	Adenocarcinoma	Ov.adenocarcinoma

### Group W

[Age at exposures: 90 days/AMAD: 0.33/GSD: 1.9]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
W-1-4-1	445	464	2.59	Adenoma	Urin.BI.SCC
W-1-1-1	449	471	2.62	Adenoma	
W-1-4-2	444	490	2.63	Adenocarcinoma	
W-1-1-2	418	505	2.50		
W-2-3-1	70	550	0.43		
W-1-2-1	449	559	2.80		Ov.adenosarcoma
W-1-2-2	446	559	2.78	Adenocarcinoma	
W-2-2-1	60	567	0.37	Adenoma	
W-1-2-3	425	634	2.78	Adenoma	Ov.adenocarcinoma
W-1-2-4	423	634	2.77	Adenocarcinoma	Mam.fibroadenoma
W-1-4-3	397	655	2.63	Adenoma	
W-2-2-2	54	657	0.36		
W-2-4-1	68	663	0.45		Mam.fibroadenoma
W-1-1-3	388	674	2.60	Adenocarcinoma	
W-1-3-1	493	718	3.38	Adenocarcinoma	
W-1-3-2	424	729	2.93		Ov.adenocarcinoma
W-1-4-4	377	740	2.61	Adenocarcinoma	
W-1-4-5	342	750	2.38	Adenocarcinoma	
W-2-2-3	54	764	0.38		
W-2-1-2	57	770	0.40		Ov.adenocarcinoma
W-1-3-3	407	770	2.87	Adenocarcinoma	
W-1-3-4	397	778	2.81	Adenocarcinoma	
W-1-2-5	371	785	2.63	Adenoma	Ov.adenocarcinoma
W-2-3-2	67	826	0.48		Mam.tumor
W-1-1-4	362	828	2.62	Adenosquamous carcinoma	
W-1-3-5	363	829	2.63	Adenocarcinoma	Ov.adenocarcinoma
W-2-1-3	55	833	0.40		
W-1-1-5	347	839	2.53	Adenocarcinoma	
W-2-4-2	57	848	0.42		
W-2-2-4	51	873	0.38	Squamous cell carcinoma	
W-2-4-4	52	901	0.39		Mam.tumor
W-2-1-4	53	943	0.40	Adenocarcinoma	Mam.fibrosarcoma
W-2-3-3	60	966	0.46	Adenoma	
W-2-2-5	39	982	0.30		Ov.adenocarcinoma
W-2-4-5	44	990	0.34	Adenoma	
W-2-3-4	44	937	0.34	Adenoma	
W-2-3-5	56	1034	0.43	Adenoma	
W-2-1-5	50	1077	0.39	Adenoma	



**Group X**

[Age at exposures: 71 days/AMAD: 0.33/GSD: 2.4]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology		
				Lung Tumors	Other Tumors	
X-3-4-2	56	572	0.36	Adenoma		
X-3-1-1	67	595	0.44			
X-3-1-2	44	643	0.30			
X-3-2-1	53	649	0.36			
X-3-3-1	50	651	0.34			
X-3-3-2	45	654	0.31			
X-3-2-2	46	735	0.33			
X-3-4-3	32	776	0.23			
X-3-2-3	41	777	0.30			
X-3-3-3	38	778	0.28			
X-3-2-4	41	782	0.30	Adenoma		
X-3-1-3	41	787	0.30			
X-3-1-4	26	826	0.19	Adenoma		
X-3-4-4	30	855	0.23	Adenocarcinoma		
X-3-3-4	36	857	0.27			
X-3-4-5	23	875	0.17	Thyroid carcinoma		
X-3-2-5	38	892	0.29	Urin.Bl.carcinoma		
X-3-3-5	33	911	0.25			

### Group Y

[Age at exposures: 77 days/AMAD: 0.39/GSD: 2.2]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
Y-2-3-1	371	486	2.28	Adenocarcinoma	Mam.tumor
Y-1-3-1	447	611	2.99	Squamous cell carcinoma	
Y-1-1-1	418	649	2.86		
Y-1-3-2	404	649	2.76	Squamous cell carcinoma	
Y-2-4-1	365	675	2.53		
Y-1-4-1	530	710	3.75	Adenoma	Ov.adenocarcinoma
Y-1-3-3	392	728	2.80	Adenoma	
Y-2-1-1	294	728	2.10	Adenocarcinoma	Ov.adenocarcinoma
Y-2-4-2	329	746	2.37	Adenoma	
Y-2-2-1	312	750	2.25	Adenoma	
Y-2-4-3	320	751	2.31	Adenoma	
Y-2-2-2	312	765	2.27	Adenocarcinma	
Y-1-1-2	403	766	2.93	Adenocarcinoma	
Y-2-2-3	272	772	1.98	Adenocarcinoma	
Y-1-1-3	402	775	2.94	Adenoma	Mam.fibroma
Y-2-1-2	284	780	2.08	Adenocarcinoma	
Y-2-3-2	271	780	1.98	Adenocarcinoma	
Y-1-4-2	367	783	2.69	Adenosquamous carcinoma	
Y-1-1-4	388	788	2.85	Adenocarcinoma	
Y-1-2-1	410	792	3.02	Adenocarcinoma	
Y-1-1-5	313	795	2.31	Adenocarcinoma	
Y-1-3-4	382	799	2.82	Adenocarcinoma	
Y-2-1-3	283	804	2.10	Adenocarcinoma	Mam.tumor
Y-2-4-4	264	808	1.96	Adenocarcinoma	
Y-1-3-5	374	819	2.79	Adenocarcinoma	Ov.adenocarcinoma
Y-2-2-4	261	833	1.96		Ov.adenocarcinoma
Y-1-2-2	380	839	2.86	Squamous cell carcinoma	Mam.tumor
Y-1-2-3	371	846	2.80	Adenocarcinoma	Mam.tumor
Y-1-4-3	344	855	2.61	Adenocarcinoma	Urin.Bl.carcinoma
Y-1-4-4	341	887	2.62	Adenocarcinoma	
Y-2-1-4	258	912	2.00	Adenocarcinoma	
Y-2-3-3	263	928	2.05	Adenocarcinoma	
Y-2-1-5	239	932	1.87	Adenocarcinoma	
Y-2-3-4	226	934	1.77	Adenocarcinoma	
Y-1-4-5	325	939	2.55	Adenocarcinoma	
Y-2-4-5	234	973	1.86	Squamous cell carcinoma	
Y-2-3-5	224	974	1.78	Adenocarcinoma	
Y-2-2-5	259	1001	2.08	Adenocarcinoma	
Y-1-2-4	322	1022	2.58	Adenocarcinoma	

### Group Z

[Age at exposures: 97 days/AMAD: 0.41/GSD: 2.3]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
Z-1-4-1	126	30	0.18		
Z-1-4-2	199	30	0.29		
Z-1-4-3	235	30	0.34		
Z-1-4-4	267	30	0.39		
Z-2-4-1	298	30	0.44		
Z-2-4-2	438	30	0.64		
Z-2-4-3	418	30	0.61		
Z-2-4-4	368	30	0.54		
Z-2-3-1	250	90	0.75		
Z-2-3-2	352	90	1.06		
Z-2-3-3	471	90	1.42		
Z-2-3-4	383	90	1.15		
Z-2-3-5	443	90	1.33		
Z-2-2-1	330	90	0.99		
Z-2-2-2	281	90	0.84		
Z-2-2-3	346	90	1.04		
Z-2-2-4	327	90	0.98		
Z-2-2-5	351	90	1.05		
Z-1-1-1	248	180	1.01		
Z-1-1-2	206	180	0.84		
Z-1-1-3	211	180	0.86		
Z-1-1-4	219	180	0.89		
Z-1-1-5	168	180	0.68		
Z-2-1-1	355	180	1.44		
Z-2-1-2	419	180	1.71		
Z-2-1-3	417	180	1.70		
Z-2-1-4	338	180	1.38		
Z-2-1-5	299	180	1.22		
Z-1-2-1	216	365	1.13		
Z-1-2-2	186	365	0.97	Adenoma	
Z-1-2-3	215	365	1.12	Adenoma	
Z-1-2-4	75	365	0.39		
Z-1-2-5	202	365	1.05		
Z-3-4-2	492	365	2.57	Adenoma	
Z-3-4-3	234	365	1.22		
Z-3-4-4	526	365	2.74	Adenoma	
Z-3-4-5	472	365	2.46	Adenocarcinoma	
Z-3-3-3	402	547	2.44	Adenocarcinoma	
Z-3-3-4	484	547	2.93	Adenoma	
Z-3-3-5	443	547	2.68	Adenocarcinoma	
Z-3-1-1	518	551	3.15	Adenoma	
Z-3-1-2	417	551	2.54	Adenocarcinoma	
Z-3-1-3	486	551	2.96	Adenoma	
Z-3-1-4	399	551	2.43	Adenocarcinoma	
Z-3-1-5	502	551	3.05	Adenoma	
Z-3-2-2	447	730	3.04	Adenocarcinoma	
Z-3-2-3	395	730	2.68	Squamous cell Ca	
Z-3-2-4	412	730	2.80	Adenocarcinoma	
Z-3-2-5	492	730	3.34	Adenocarcinoma	

### Group Z (Cont'd)

[Age at exposures: 97 days/AMAD: 0.41/GSD: 2.3]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
Z-3-4-1	558	155	2.15		
Z-1-3-1	175	366	0.91		
Z-1-3-2	175	367	0.98		
Z-1-3-3	185	435	1.03	Adenocarcinoma	
Z-3-3-1	472	460	2.68	Adenoma	
Z-3-3-2	418	460	2.38	Adenoma	Mam.fibroma
Z-1-3-4	171	632	1.10		
Z-1-3-5	35	663	0.23		meta.Ov.Ca
Z-3-2-1	498	668	3.27	Adenocarcinoma	

### Group A'

[Age at exposures: 93 days/AMAD: 0.40/GSD: 2.1]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
A'-1-3-1	312	180	1.27		
A'-1-3-2	310	180	1.26		
A'-1-3-3	417	180	1.70		
A'-1-3-4	370	180	1.51		
A'-1-3-5	352	180	1.43		
A'-2-3-1	449	180	1.83		
A'-2-3-2	328	180	1.33		
A'-2-3-3	488	180	1.99		
A'-2-3-4	391	180	1.59		
A'-2-3-5	372	180	1.51		
A'-1-2-1	363	365	1.89		
A'-1-2-2	282	365	1.47	Adenoma	
A'-1-2-3	323	365	1.68	Adenoma	
A'-1-2-4	297	365	1.55	Adenoma	
A'-1-2-5	295	365	1.54	Adenocarcinoma	
A'-2-4-2	402	365	2.10	Adenoma	
A'-2-4-3	357	365	1.86	Adenoma	
A'-2-4-4	351	365	1.83	Adenoma	
A'-2-4-5	439	365	2.29	Adenocarcinoma	
A'-1-1-1	318	545	1.93		
A'-1-1-2	222	545	1.34	Adenoma	
A'-1-1-3	319	545	1.93	Adenocarcinoma	
A'-1-1-4	244	545	1.48	Adenoma	
A'-1-1-5	286	545	1.73	Adenocarcinoma	
A'-2-1-3	383	730	2.60	Adenocarcinoma	
A'-2-1-4	419	730	2.85	Adenocarcinoma	
A'-2-1-5	380	730	2.58	Adenocarcinoma	

**Group A' (Cont'd)**

[Age at exposures: 93 days/AMAD: 0.40/GSD: 2.1]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
A'-2-4-1	504	243	2.29		
A'-2-2-1	471	324	2.36	Adenocarcinoma	
A'-1-4-1	434	358	2.25	Adenoma	
A'-2-1-1	445	413	2.43	Adenocarcinoma	
A'-2-2-2	455	557	2.78	Adenoma	
A'-1-4-2	455	558	2.54	Squamous cell Ca	
A'-2-1-2	462	597	2.90	Adenocarcinoma	
A'-1-4-3	410	658	2.68	Adenosquamous Ca	
A'-1-4-4	391	716	2.63	Adenocarcinoma	
A'-2-2-3	417	777	2.90	Adenocarcinoma	
A'-1-4-5	375	793	2.63	Adenocarcinoma	
A'-2-2-4	356	795	2.50	Adenosquamous Ca	
A'-2-2-5	341	804	2.41	Adenocarcinoma	

**Group B' (next page)**

[Age at exposures: 126 days/AMAD: 0.39/GSD: 2.0]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
B'-1-2-1	34	174	0.12	Adenoma	Ov.fibroadenocarcinoma
B'-1-2-2	40	379	0.19		
B'-1-1-1	62	420	0.31		
B'-3-3-1	53	428	0.27		
B'-3-1-1	44	458	0.23		
B'-2-1-1	45	467	0.23		
B'-3-4-1	47	470	0.24		
B'-1-2-3	30	519	0.16		
B'-2-4-1	31	594	0.18		
B'-1-3-1	63	671	0.38		
B'-2-2-1	49	673	0.30	Metaplasia	Mam.tumor meta.Osteosarcoma Mam.tumor Urin.Bl.carcinoma
B'-3-3-2	31	674	0.19		
B'-1-3-2	52	675	0.32		
B'-3-4-2	46	693	0.28		
B'-1-4-1	31	703	0.19		
B'-3-2-1	38	707	0.23		
B'-2-4-2	28	730	0.17		
B'-3-4-3	28	732	0.17		
B'-2-1-2	34	732	0.21		
B'-2-3-1	45	733	0.28		
B'-3-2-2	30	746	0.19	Metaplasia	Ov.fibrosarcoma
B'-1-2-4	19	753	0.12		
B'-2-4-3	23	762	0.15		
B'-2-3-2	41	765	0.26		
B'-2-3-3	28	765	0.18		
B'-1-1-2	40	772	0.26		
B'-3-3-3	28	791	0.18		
B'-3-1-2	40	797	0.26		
B'-2-1-3	31	802	0.20		
B'-3-1-3	40	816	0.26		
B'-2-1-4	23	821	0.15	Adenoma	Hepatocellular carcinoma Mam.tumor SC adenocarcinoma Ov.fibroadenocarcinoma Mam.tumor Adrenal tumor Mam.fibroma
B'-1-1-3	28	838	0.19		
B'-2-2-2	28	845	0.19		
B'-3-3-4	24	852	0.16		
B'-2-3-4	23	855	0.15		
B'-3-4-4	24	859	0.16		
B'-3-2-3	28	860	0.19		
B'-2-1-5	17	869	0.11		
B'-2-2-3	23	876	0.15		
B'-2-4-4	17	877	0.12		
B'-1-3-3	38	882	0.26	Adenoma	meta.Ov.FAC/Mam.F. meta.Mam.fibrosarcoma Mam.tumor
B'-1-4-2	28	882	0.19		
B'-2-3-5	17	896	0.12		
B'-3-1-4	28	897	0.19		
B'-1-4-3	19	898	0.13		
B'-3-3-5	17	898	0.12		
B'-3-2-4	24	920	0.17		
B'-3-1-5	24	922	0.17		
B'-2-2-4	17	926	0.12		
B'-3-2-5	17	931	0.12		
B'-1-1-4	18	936	0.12	Adenoma	Mam.tumor Hepatocellular carcinoma Mam. tumor
B'-2-2-5	6	967	0.04		
B'-1-3-4	32	984	0.23		
B'-1-3-5	28	987	0.20		
B'-1-1-5	6	989	0.04		
B'-1-2-5	7	1012	0.05		
B'-2-4-5	6	1019	0.04		
B'-1-4-4	7	1024	0.05		
B'-3-4-5	17	1033	0.12		

### Group C'

[Age at exposures: 115 days/AMAD: 0.39/GSD: 2.0]

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathology	
				Lung Tumors	Other Tumors
C'-1-4-1	61	116	0.19		
C'-1-2-1	48	469	0.26		
C'-2-1-1	39	492	0.21	Metaplasia	
C'-2-2-1	46	510	0.25		
C'-2-3-1	42	553	0.24		
C'-3-2-1	52	560	0.30		
C'-2-4-1	43	562	0.25		
C'-2-1-2	37	586	0.22	Metaplasia	
C'-2-4-2	32	587	0.19		Ov.fibroadenocarcinoma
C'-3-4-1	56	610	0.33	Metaplasia	
C'-1-3-1	46	616	0.27	Adenoma	
C'-3-3-1	52	623	0.31		meta.Ov.fibroadenocarc.
C'-3-4-2	35	630	0.21		meta.Ov.fibroadenocarc.
C'-1-2-2	39	633	0.24		
C'-1-1-1	41	633	0.25		Mam.adenoma
C'-1-2-3	38	639	0.23		Urin.B1.SCC
C'-3-4-3	32	643	0.19		Mam.fibroma
C'-3-4-4	31	649	0.19		meta.Ov.fibroadenocarc.
C'-3-4-5	17	656	0.10	Metaplasia	
C'-2-1-3	37	660	0.23	Adenoma	
C'-3-2-2	40	668	0.25	Adenoma	
C'-1-4-2	39	674	0.24		
C'-2-2-2	39	681	0.24		Mam.tumor
C'-2-1-4	34	686	0.21		Ov.adenocarcinoma
C'-1-2-4	19	689	0.12		meta.Ov.fibroadenocarc.
C'-3-2-3	39	693	0.24	Adenocarcinoma	Mam.fibroadenoma
C'-1-4-3	32	701	0.20		
C'-2-4-3	17	704	0.11		Ov.tumor/Mam.tumor
C'-3-1-1	54	705	0.34		
C'-3-1-2	46	713	0.29		meta.Mam.adenocarc.
C'-2-2-3	37	714	0.23		
C'-2-3-2	37	715	0.23		meta.Ov.fibroadenocarc.
C'-1-3-2	35	729	0.22	Adenoma	Mam.fibroma
C'-1-2-5	7	740	0.04		meta.fibroadenocarc.
C'-3-3-2	48	747	0.31		
C'-3-3-3	41	750	0.27		
C'-2-2-4	30	768	0.20		
C'-1-3-3	34	793	0.23		
C'-3-1-3	42	821	0.28	Adenocarcinoma	
C'-2-3-3	35	836	0.24		
C'-3-3-4	17	844	0.11		
C'-1-4-4	28	872	0.19		
C'-1-1-2	28	890	0.19		
C'-3-2-4	34	900	0.24		
C'-2-1-5	30	905	0.21		Mam.tumor
C'-3-1-4	28	917	0.20		meta.OvT/Mam.tumor
C'-1-4-5	18	919	0.13		Mam.adenocarcinoma
C'-3-1-5	24	922	0.17		Mam.tumor
C'-2-3-4	23	924	0.16	Adenoma	Hepatocellular carcinoma
C'-2-3-5	7	931	0.05		Adrenal adenoma
C'-1-1-3	19	943	0.13	Adenoma	
C'-3-2-5	17	1043	0.12	Adenocarcinoma	Mam.fibroma
C'-1-3-4	nd	1087	<0.15		
C'-1-1-4	7	1098	0.05	Adenoma	
C'-2-4-4	6	1098	0.04		

### 3.1.2 Experimental Groups for X-ray Irradiation

#### Groups of Control Animals for Whole-Body X-Irradiation

The control groups of unirradiated animals for whole-body X-irradiation (WBX) as listed below correspond to each of experimental groups of irradiated animals (Groups X-1 to X-6), respectively.

#### Control Groups for WBX

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung Tumors	Other Tumors
X-1-Ct1-1	0	716	596		
X-1-Ct1-2	0	723	603		Ov.adenocarcinoma
X-1-Ct1-3	0	842	722		Uterus tumor
X-1-Ct1-4	0	858	738		
X-1-Ct1-5	0	893	773		
X-1-Ct2-1	0	674	554		
X-1-Ct2-2	0	688	568		
X-1-Ct2-3	0	702	582		
X-1-Ct2-4	0	832	712		
X-1-Ct2-5	0	851	731		
X-1-Ct3-1	0	685	565		
X-1-Ct3-2	0	842	722		
X-1-Ct3-3	0	870	750		
X-1-Ct3-4	0	902	782		Ov.adenocarcinoma
X-1-Ct3-5	0	926	806		
X-1-Ct4-1	0	613	493		
X-1-Ct4-2	0	881	761		
X-1-Ct4-3	0	895	775		
X-1-Ct4-4	0	912	792		Myel.leukemia/Ov.adenocarcinoma
X-1-Ct4-5	0	926	806		Ov.adenocarcinoma
X-2-Ct1-1	0	493			
X-2-Ct1-2	0	772			
X-2-Ct1-3	0	772			
X-2-Ct1-4	0	786			Ov.carcinoma
X-2-Ct1-5	0	879			meta.Ut.carcinoma
X-2-Ct2-1	0	790			Ov.adenocarcinoma
X-2-Ct2-2	0	874			
X-2-Ct2-3	0	874			Ov.adenocarcinoma
X-2-Ct2-4	0	982			
X-2-Ct2-5	0	993			
X-2-Ct3-4	0	611			
X-2-Ct3-5	0	839			Ov.adenocarcinoma
X-2-Ct4-3	0	646			
X-2-Ct4-4	0	744			
X-2-Ct4-5	0	916			
X-2-Ct5-1	0	576			
X-2-Ct5-2	0	597			
X-2-Ct5-3	0	629			
X-2-Ct5-4	0	696			Ov.adenocarcinoma
X-2-Ct5-5	0	877			Ov.adenocarcinoma



**Control Groups for WBX (Cont'd)**

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung Tumors	Other Tumors
X-2-Ct6-1	0	618			
X-2-Ct6-2	0	625			
X-2-Ct6-3	0	751			Mam.tumor
X-2-Ct6-4	0	894			Ut.carcinoma
X-2-Ct6-5	0	937			
X-2-Ct7-1	0	737			
X-2-Ct7-2	0	781			
X-2-Ct7-3	0	809			
X-2-Ct7-4	0	809			
X-2-Ct7-5	0	828			
X-2-Ct8-1	0	874			
X-2-Ct8-2	0	912			
X-2-Ct8-3	0	944			
X-2-Ct8-4	0	1052			Ov.adenocarcinoma
X-2-Ct8-5	0	1054			
X-2-Ct9-4	0	739			
X-2-Ct9-5	0	898			
X-2-Ct10-1	0	597			Ov.adenocarcinoma
X-2-Ct10-2	0	622			
X-2-Ct10-3	0	731			Mam.fibrosarcoma/Pancreatic adenoma
X-2-Ct10-4	0	877			Mam.adenocarcinoma
X-2-Ct10-5	0	891			Ov.adenocarcinoma
X-2-Ct11-1	0	762			
X-2-Ct11-2	0	802			
X-2-Ct11-3	0	881			
X-2-Ct11-4	0	1091			
X-2-Ct11-5	0	1091			
X-2-Ct12-1	0	857			
X-2-Ct12-2	0	877			
X-2-Ct12-3	0	905			
X-2-Ct12-4	0	951			Ov.adenocarcinoma
X-2-Ct12-5	0	979			
X-2-Ct13-1	0	734			
X-2-Ct13-2	0	776			
X-2-Ct13-3	0	877			
X-2-Ct13-4	0	905			Ut.carcinoma
X-2-Ct13-5	0	982			meta.Ov.adenocarcinoma

### **Control Groups for WBX (Cont'd)**

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung Tumors	Other Tumors
X-5-Ct1-1	0	454	338		Ov.adenocarcinoma
X-5-Ct1-2	0	666	550		Ov.adenocarcinoma
X-5-Ct1-3	0	787	671		
X-5-Ct1-4	0	831	715		Abdominal fibrosarcoma
X-5-Ct1-5	0	861	745		Ov.adenocarcinoma
X-5-Ct2-1	0	608	492		
X-5-Ct2-2	0	652	536		
X-5-Ct2-3	0	724	608		M.fibroma
X-5-Ct2-4	0	775	659		
X-5-Ct2-5	0	817	701		
X-5-Ct3-1	0	543	427		
X-5-Ct3-2	0	728	612		meta.Ov.adenocarcinoma
X-5-Ct3-3	0	819	703		Mam.fibroma
X-5-Ct3-4	0	852	736		
X-5-Ct4-1	0	777	661		
X-5-Ct4-2	0	838	722		
X-5-Ct4-3	0	852	736		
X-5-Ct4-4	0	878	762		Ut.fibrosarcoma
X-5-Ct4-5	0	892	776		Ut.carcinoma
X-6-Ct1-1	0	785	626		
X-6-Ct1-2	0	817	658		Mam.fibroma
X-6-Ct1-3	0	911	752		
X-6-Ct1-4	0	922	763		Ov.adenocarcinoma
X-6-Ct1-5	0	950	791		Ut.carcinoma/Mam.fibroadenoma
X-6-Ct2-1	0	421	262		
X-6-Ct2-2	0	540	381		
X-6-Ct2-3	0	710	551		
X-6-Ct2-4	0	726	567		
X-6-Ct2-5	0	890	731		

### **Groups of Whole-Body X-Irradiated Animals**

The experimental groups of whole-body X-irradiated animals as listed below include the Groups X-1 to X-6, and the information on the experimental regimens including the age of animals at the cessation of irradiation and the total doses, is attached to the head of the table for each group, respectively.

### **Group X - 1**

[Age at the cessation of irradiation: 120 days/Total dose: 0.5 to 5.0 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung Tumors	Other Tumors
X-1-1-1	0.5	704	616		
X-1-1-2	0.5	729	641		Mam.tumor
X-1-1-3	0.5	851	763		
X-1-1-4	0.5	881	793		Mam.fibroma
X-1-1-5	0.5	953	865		
X-1-2-1	0.5	719	631		
X-1-2-2	0.5	858	770		
X-1-2-3	0.5	893	805		
X-1-2-4	0.5	916	828		Osteosarcoma
X-1-2-5	0.5	974	886		Mam.fibrosarcoma
X-1-3-1	1.0	565	473		
X-1-3-2	1.0	678	586		
X-1-3-3	1.0	739	647		Mam.fibroadenoma
X-1-3-4	1.0	911	819		Ov.adenocarcinoma
X-1-3-5	1.0	956	864		
X-1-4-1	1.0	508	416		
X-1-4-2	1.0	767	675		
X-1-4-3	1.0	771	679		Mam.adenoma
X-1-4-4	1.0	818	726		
X-1-4-5	1.0	967	875		Mam.tumor
X-1-5-1	2.0	627	528		
X-1-5-2	2.0	676	577		Ov.adenocarcinoma
X-1-5-3	2.0	732	633		
X-1-5-4	2.0	761	662		
X-1-6-1	2.0	624	525		
X-1-6-2	2.0	627	528		
X-1-6-3	2.0	721	622		
X-1-6-4	2.0	746	647		
X-1-6-5	2.0	795	696		Adrenal carcinoma
X-1-7-1	3.0	323	217		
X-1-7-2	3.0	769	663		Mam.fibroma
X-1-7-3	3.0	795	689		Thyroid adenocarcinoma
X-1-7-4	3.0	837	731		Hepatocellular carcinoma
X-1-7-5	3.0	860	754		Mam.tumor
X-1-8-1	3.0	270	164		
X-1-8-2	3.0	697	591		
X-1-8-3	3.0	760	654		
X-1-8-4	3.0	769	663		
X-1-8-5	3.0	886	780		
X-1-9-3	5.0	627	507		
X-1-9-4	5.0	662	542		
X-1-9-5	5.0	676	556		
X-1-10-1	5.0	646	526		
X-1-10-2	5.0	652	532		
X-1-10-3	5.0	732	612		Mam.fibroadenoma
X-1-10-4	5.0	762	642		
X-1-10-5	5.0	764	644	Adenocarcinoma	Ur.Bl.fibrosarcoma

### **Group X-3**

[Age at the cessation of irradiation: 120 days/Total dose: 0.5 to 5.0 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology		
				Lung Tumors	Other Tumors	
X-3-1-1	0.5	501	413	Adenocarcinoma	Mam.fibrosarcoma	
X-3-1-2	0.5	722	634			
X-3-1-3	0.5	825	737			
X-3-1-4	0.5	865	777			
X-3-1-5	0.5	993	905		Ur.BI.fibrosarcoma	
X-3-2-1	0.5	564	476			
X-3-2-2	0.5	568	480		Ov.adenocarcinoma	
X-3-2-3	0.5	592	504			
X-3-2-4	0.5	798	710			
X-3-2-5	0.5	830	742			
X-3-3-2	0.5	536	448		Ov.adenocarcinoma	
X-3-3-3	0.5	823	735			
X-3-3-4	0.5	932	844			
X-3-3-5	0.5	1033	945			
X-3-4-1	0.5	701	613		Ov.adenocarcinoma	
X-3-4-2	0.5	830	742			
X-3-4-3	0.5	880	792	Ov.adenocarcinoma		
X-3-4-4	0.5	883	795			
X-3-4-5	0.5	902	814			
X-3-5-2	1.0	421	329		Ov.adenocarcinoma	
X-3-5-3	1.0	610	518			
X-3-5-4	1.0	704	612			
X-3-5-5	1.0	907	815			
X-3-6-1	1.0	613	521			
X-3-6-2	1.0	617	525			
X-3-6-3	1.0	650	558			
X-3-6-4	1.0	746	654			
X-3-6-5	1.0	812	720			
X-3-7-2	2.0	638	539	Adenoma	Ut.carcinoma	
X-3-7-3	2.0	683	584			
X-3-7-4	2.0	774	675	Adenoma	Ov.adenocarcinoma Mam.fibroadenoma	
X-3-7-5	2.0	832	733			
X-3-8-1	2.0	459	360			
X-3-8-2	2.0	727	628			
X-3-8-3	2.0	771	672			
X-3-8-4	2.0	809	710			
X-3-8-5	2.0	858	759			
X-3-9-1	3.0	603	497	Adenoma	Mam.fibroadenoma Osteosarcoma	
X-3-9-2	3.0	603	497			
X-3-9-3	3.0	624	518			
X-3-9-4	3.0	812	706			
X-3-9-5	3.0	858	752			
X-3-10-1	3.0	293	187		Adenocarcinoma	Mam.adenoma Mam.fibroma
X-3-10-2	3.0	715	609			
X-3-10-3	3.0	720	614			
X-3-10-4	3.0	844	738			
X-3-10-5	3.0	883	777			
X-3-11-2	5.0	622	502		Mam.fibroadenoma Mam.fibroma Mam.tumor	
X-3-11-3	5.0	638	518			
X-3-11-4	5.0	809	689			
X-3-11-5	5.0	858	738			
X-3-12-2	5.0	522	402			
X-3-12-3	5.0	662	542		Mam.fibroma	
X-3-12-4	5.0	761	641			
X-3-12-5	5.0	888	768			

### **Group X-4**

[Age at the cessation of irradiation: 124 days/Total dose: 0.5 to 5.0 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung Tumors	Other Tumors
X-4-1-1	0.5	617	525		Ov.adenocarcinoma Mam.fibroma  Ov.adenocarcinoma Ov.adenocarcinoma
X-4-1-2	0.5	663	571		
X-4-1-3	0.5	750	658		
X-4-1-4	0.5	782	690		
X-4-1-5	0.5	862	770		
X-4-2-1	0.5	705	613		
X-4-2-2	0.5	715	623		
X-4-2-3	0.5	815	723		
X-4-2-4	0.5	876	784		
X-4-2-5	0.5	911	819		
X-4-3-1	1.0	520	424	Adenoma	Ov.adenocarcinoma   Myeloma          Ut.carcinoma/Mam.adenocarcinoma
X-4-3-2	1.0	565	469		
X-4-3-3	1.0	659	563		
X-4-3-4	1.0	677	581		
X-4-3-5	1.0	878	782		
X-4-4-1	1.0	386	290		
X-4-4-2	1.0	435	339		
X-4-4-3	1.0	460	364		
X-4-4-4	1.0	467	371		
X-4-4-5	1.0	712	616		
X-4-5-1	1.0	507	411		
X-4-5-2	1.0	612	516		
X-4-5-3	1.0	708	612		
X-4-5-4	1.0	876	780		
X-4-5-5	1.0	925	829		
X-4-6-1	1.0	598	502	Adenocarcinoma	Ov.adenocarcinoma
X-4-6-2	1.0	626	530		
X-4-6-3	1.0	677	581		
X-4-6-4	1.0	813	717		
X-4-6-5	1.0	862	766		
X-4-7-1	2.0	547	444	Adenoma	Ov.adenocarcinoma  Mam.fibroadenoma Ov.adenocarcinoma  Mam.fibroadenoma Mam.fibroma  Mam.fibroma Ut.carcinoma  Adrenal carcinoma
X-4-7-2	2.0	619	516		
X-4-7-3	2.0	754	651		
X-4-7-4	2.0	801	698		
X-4-7-5	2.0	939	836		
X-4-8-1	2.0	736	633		
X-4-8-2	2.0	750	647		
X-4-8-3	2.0	768	665		
X-4-8-4	2.0	813	710		
X-4-8-5	2.0	864	761		
X-4-9-1	2.0	449	346		
X-4-9-2	2.0	449	346		
X-4-9-3	2.0	512	409		
X-4-9-4	2.0	757	654		
X-4-9-5	2.0	869	766		
X-4-10-1	2.0	414	311		
X-4-10-2	2.0	428	325		
X-4-10-3	2.0	449	346		
X-4-10-4	2.0	715	612		
X-4-10-5	2.0	736	633		

### **Group X-4 (Cont'd)**

[Age at the cessation of irradiation: 124 days/Total dose: 0.5 to 5.0 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung Tumors	Other Tumors
X-4-11-1	3.0	351	241	Adenosquam.Ca	Ov.adenocarcinoma/Mam.fibroma
X-4-11-2	3.0	680	570		
X-4-11-3	3.0	745	635		Ut.carcinoma
X-4-11-4	3.0	817	707		Ov.adenocarcinoma
X-4-11-5	3.0	859	749		
X-4-12-1	3.0	626	516		meta.Ov.adenocarcinoma
X-4-12-2	3.0	726	616		Mam.tumor
X-4-12-3	3.0	750	640		Mam.fibroma
X-4-12-4	3.0	780	670		
X-4-12-5	3.0	932	822		
X-4-13-1	3.0	444	334		
X-4-13-2	3.0	547	437		Ut.carcinoma
X-4-13-3	3.0	582	472		Mam.adenoma
X-4-13-4	3.0	624	514		
X-4-13-5	3.0	683	573		Ur.Bl.Ca/Mam.fibroadenoma
X-4-14-1	3.0	502	392	Adenocarcinoma	
X-4-14-2	3.0	646	536		meta.Sarcoma
X-4-14-3	3.0	827	717		Mam.fibroma
X-4-14-4	3.0	831	721		Mam.fibroadenoma
X-4-14-5	3.0	887	777		Ov.adenocarcinoma
X-4-15-1	5.0	369	245		Ov.tumor/Mam.tumor
X-4-15-2	5.0	640	516		Mam.adenoma
X-4-15-3	5.0	677	553		Mam.fibroadenoma
X-4-15-4	5.0	782	658		Pancreat.adenocarcinoma/Mam.fibroma
X-4-15-5	5.0	925	801		
X-4-16-1	5.0	470	346		
X-4-16-2	5.0	654	530		Ov.adenocarcinoma
X-4-16-3	5.0	710	586		Ov.adenocarcinoma
X-4-16-4	5.0	765	641		Mam.fibroadenoma
X-4-16-5	5.0	827	703		Mam.fibroadenoma

### **Group X-5**

[Age at the cessation of irradiation: 116 days/Total dose: 0.5 to 5.0 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung Tumors	Other Tumors
X-5-1-1	0.5	714	626		Mam.fibroadenoma
X-5-1-2	0.5	749	661		Ov.adenocarcinoma
X-5-1-3	0.5	775	687		
X-5-1-4	0.5	810	722		Mam.adenoma
X-5-1-5	0.5	812	724		Mam.fibroadenoma
X-5-2-1	0.5	489	401		
X-5-2-2	0.5	685	597		Mam.fibroadenoma
X-5-2-3	0.5	708	620		meta.Ov.adenocarcinoma
X-5-2-4	0.5	724	636		
X-5-2-5	0.5	731	643		
X-5-3-1	1.0	335	243		
X-5-3-2	1.0	726	634		Ov.carcinoma
X-5-3-3	1.0	810	718		
X-5-3-4	1.0	850	758		Ov.adenocarcinoma
X-5-3-5	1.0	922	830		
X-5-4-1	1.0	575	483		
X-5-4-2	1.0	714	622		meta.Ov.adenocarcinoma
X-5-4-3	1.0	787	695		Ov.adenocarcinoma
X-5-4-4	1.0	857	765		Ov.adenocarcinoma
X-5-4-5	1.0	857	765		Ov.adenocarcinoma/Mam.fibroma
X-5-5-1	2.0	543	444		
X-5-5-2	2.0	754	655		
X-5-5-3	2.0	784	685		
X-5-5-4	2.0	810	711		Mam.fibroadenoma
X-5-5-5	2.0	824	725		
X-5-6-1	2.0	433	334		
X-5-6-2	2.0	717	618		
X-5-6-3	2.0	752	653		Mam.adenocarcinoma
X-5-6-4	2.0	815	716		Ov.adenocarcinoma
X-5-6-5	2.0	882	783		Ov.adenocarcinoma
X-5-7-1	3.0	536	430		
X-5-7-2	3.0	648	542		Mam.adenoma
X-5-7-3	3.0	714	608		
X-5-7-4	3.0	731	625		Ov.adenocarcinoma/Mam.fibroadenoma
X-5-7-5	3.0	780	674		Mam.adenocarcinoma
X-5-8-1	3.0	650	544		
X-5-8-2	3.0	659	553		
X-5-8-3	3.0	701	595		
X-5-8-4	3.0	745	639		Ut.tumor
X-5-8-5	3.0	889	783		Thyr.adenocarcinoma

### Group X-5 (Cont'd)

[Age at the cessation of irradiation: 116 days/Total dose: 0.5 to 5.0 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung Tumors	Other Tumors
X-5-9-1	5.0	545	429	Adenocarcinoma	
X-5-9-2	5.0	721	605		Mam.fibroma
X-5-9-3	5.0	735	619		
X-5-9-4	5.0	796	680		Mam.adenoma
X-5-9-5	5.0	896	780		Ov.adenocarcinoma/Mam.fibrosarcoma
X-5-10-1	5.0	568	452		
X-5-10-2	5.0	717	601		Mam.adenoma
X-5-10-3	5.0	745	629		Ov.adenocarcinoma/Mam.fibroma
X-5-10-4	5.0	749	633		Mam.adenocarcinoma
X-5-10-5	5.0	768	652		Mam.fibroma
X-5-11-1	5.0	379	263		
X-5-11-2	5.0	477	361		Ut.fibrosarcoma
X-5-11-3	5.0	586	470		
X-5-11-4	5.0	596	480		Mam.adenocarcinoma
X-5-11-5	5.0	641	525		
X-5-12-1	5.0	714	598		Mam.adenocarcinoma
X-5-12-2	5.0	731	615		Ov.adenocarcinoma/Mam.fibroma
X-5-12-3	5.0	752	636		
X-5-12-4	5.0	770	654		Mam.adenoma
X-5-12-5	5.0	901	785		Mam.fibroadenoma



### Group X-6

[Age at the cessation of irradiation: 159 days/Total dose: 10 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung Tumors	Other Tumors
X-6-1-1	10	435	276	Undif.carcinoma	
X-6-1-2	10	530	371		
X-6-1-3	10	607	448		meta.Ov.adenocarcinoma
X-6-1-4	10	621	462		
X-6-1-5	10	736	577		Ut.fibrosarcoma/Mam.fibroadenoma
X-6-2-1	10	320	161		meta.SC.adenocarcinoma
X-6-2-2	10	394	235		
X-6-2-3	10	435	276		
X-6-2-4	10	701	542		Mam.adenoma
X-6-2-5	10	750	591		Ur.Bl.Transitional Ca
X-6-3-2	10	304	145	Adenocarcinoma	
X-6-3-3	10	759	600		Ov.adenocarcinoma/Mam.fibroma
X-6-3-4	10	789	630		Ut.tumor
X-6-3-5	10	799	640		Ov.adenocarcinoma/Mam.fibroma
X-6-4-1	10	442	283		
X-6-4-2	10	624	465	Adenoma	Ov.adenocarcinoma/Mam.fibroma
X-6-4-3	10	656	497		meta.SC.carcinoma
X-6-4-4	10	663	504		Mam.fibroadenoma
X-6-4-5	10	729	570		Ut.tumor
X-6-5-2	10	318	159		
X-6-5-3	10	575	416		Mam.fibrosarcoma
X-6-5-4	10	642	483		Mam.fibroadenoma
X-6-5-5	10	761	602		Ut.fibrosarcoma/Mam.fibroadenoma
X-6-6-1	10	334	175		
X-6-6-2	10	379	220		
X-6-6-3	10	381	222	Adenoma	
X-6-6-4	10	589	430		meta.Ov.adenocarcinoma/Mam.adenoma
X-6-6-5	10	761	602		
X-6-7-1	10	351	192		
X-6-7-2	10	421	262		
X-6-7-3	10	514	355		Mam.tumor
X-6-7-4	10	703	544		Mam.adenoma
X-6-7-5	10	705	546		Mam.fibroma
X-6-8-1	10	257	98		
X-6-8-2	10	495	336		Histiocytic lymphoma.
X-6-8-3	10	626	467		Ov.adenocarcinoma
X-6-8-4	10	652	493		
X-6-8-5	10	717	558		Ov.carcinoma
X-6-9-1	10	306	147		Mam.adenocarcinoma
X-6-9-2	10	526	367		Ov.adenocarcinoma/Mam.adenocarcinoma
X-6-9-3	10	547	388	Undif.carcinoma	
X-6-9-4	10	591	432		Ut.fibrosarcoma
X-6-9-5	10	654	495		
X-6-10-1	10	568	409		Mam.adenoma
X-6-10-2	10	621	462		Mam.fibrosarcoma
X-6-10-3	10	691	532	Fibrosarcoma	
X-6-10-4	10	705	546		
X-6-10-5	10	736	577		Mam.fibroadenoma

## Groups of Control Animals for Thoracic X-Irradiation

The control groups of unirradiated animals for thoracic X-irradiation (ThX) as listed below correspond to each of experimental groups of irradiated animals (Groups X-8 to X-14), respectively.

### Control Groups for ThX

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung tumors	Other Tumors
X-8-Ct1-1	0	508	322		Mam.fibroma  Mam.fibroma
X-8-Ct1-2	0	852	666		
X-8-Ct1-3	0	859	673		
X-8-Ct1-4	0	999	813		
X-8-Ct1-5	0	1177	991		
X-8-Ct2-1	0	662	476		
X-8-Ct2-2	0	758	572		
X-8-Ct2-3	0	868	682		
X-9-Ct1-1	0	767	615		Mam.fibrosarcoma Mam.fibroadenoma
X-9-Ct1-2	0	874	722		
X-9-Ct1-3	0	968	816		
X-9-Ct1-4	0	1018	866		
X-9-Ct1-5	0	1062	910		
X-9-Ct2-1	0	758	606		
X-9-Ct2-2	0	982	830		
X-9-Ct2-3	0	989	837		
X-9-Ct2-4	0	1038	886		
X-9-Ct2-5	0	1157	1005		
X-10-Ct-2	0	742	636		Lymphoma  Subcutaneous.fibrosarcoma
X-10-Ct-3	0	775	669		
X-10-Ct-4	0	909	803		
X-10-Ct-5	0	980	874		
X-11-Ct-2	0	854	754		Mam.adenocarcinoma Mam.fibroadenoma
X-11-Ct-3	0	895	795		
X-11-Ct-4	0	959	859		
X-11-Ct-5	0	1119	1019		
X-12-Ct-1	0	427	319		Mam.fibroadenoma Mam.fibroma
X-12-Ct-2	0	568	460		
X-12-Ct-3	0	736	628		
X-12-Ct-4	0	850	742		
X-12-Ct-5	0	1060	952		
X-13-Ct-1	0	671	573		Mam.fibroma
X-13-Ct-2	0	698	600		
X-13-Ct-3	0	708	610		
X-13-Ct-4	0	762	664		
X-13-Ct-5	0	784	686		
X-14-Ct1-1	0	860	759	Adenoma	Mam.fibroma  Mam.fibroma/Ut.adenocarcinoma meta.Ov.adenocarcinoma Ut.fibrosarcoma  Mam.adenoma
X-14-Ct1-2	0	909	808		
X-14-Ct1-3	0	912	811		
X-14-Ct1-4	0	965	864		
X-14-Ct1-5	0	987	886		
X-14-Ct2-3	0	836	735		
X-14-Ct2-4	0	863	762		
X-14-Ct2-5	0	878	777		
X-14-Ct3-3	0	597	496		
X-14-Ct3-4	0	609	508		
X-14-Ct3-5	0	783	682		
X-14-Ct4-5	0	891	790		
X-14-Ct5-5	0	503	402		

## Groups of Thoracic X-Irradiated Animals

The experimental groups of Thoracic X-irradiated animals as listed below include the Groups X-8 to X-15, and the information on the experimental regimens including the age of animals at the irradiation and the total doses, is attached to the head of the table for each group, respectively.

### Group X-8

[Age at the irradiation: 186 days/Total dose: 3.0-5.0 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung tumors	Other Tumors
X-8-1-1	3.0	608	422	Adenocarcinoma Adenocarcinoma         Adenoma	Mam.fibroadenoma
X-8-1-2	3.0	904	718		Mam.fibroadenoma
X-8-1-3	3.0	912	726		
X-8-2-1	3.0	709	523		
X-8-2-2	3.0	918	732		
X-8-3-1	3.0	782	596		Mam.fibroadenoma
X-8-3-2	3.0	834	648		Osteosarcoma/Mam.fibroma
X-8-3-3	3.0	1017	831		meta.Ov.carcinoma/Mam.adenocarcin.
X-8-4-1	3.0	762	576		
X-8-4-2	3.0	805	619		
X-8-4-3	3.0	884	698	Adenoma	Mam.fibroma
X-8-4-4	3.0	896	710		Mam.fibroadenoma
X-8-4-5	3.0	960	774		Ov.adenocarcinoma/Mam.adenoma
X-8-5-1	5.0	489	303	Adenoma	Lymphoma
X-8-5-2	5.0	702	516		
X-8-5-3	5.0	999	813		Mam.fibroma
X-8-5-4	5.0	1027	841		Mam.adenocarcinoma
X-8-6-1	5.0	443	257		
X-8-6-2	5.0	669	483	Adenoma	
X-8-6-3	5.0	677	491		Mam.fibroma
X-8-6-4	5.0	826	640		
X-8-6-5	5.0	838	652	Squamous cell Ca	Ov.adenocarcinoma
X-8-7-1	5.0	345	159	Undif.carcinoma	
X-8-7-2	5.0	569	383		Pancreas adenoma
X-8-7-3	5.0	868	682	Adenocarcinoma	
X-8-7-4	5.0	1020	834		Mam.fibroma
X-8-8-1	5.0	789	603	Squamous cell Ca	
X-8-8-2	5.0	825	639		
X-8-8-3	5.0	972	786	Adenoma	Ov.adenocarcinoma

### Group X - 9

[Age at the irradiation: 152 days/Total dose: 3.0-5.0 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung tumors	Other Tumors
X-9-1-1	3.0	751	599	Adenocarcinoma	Mam.adenoma
X-9-1-2	3.0	851	699		
X-9-1-3	3.0	898	746		
X-9-1-4	3.0	1010	858		
X-9-2-1	3.0	634	482	Adenoma	Mam.adenoma Ov.adenocarcinoma
X-9-2-2	3.0	746	594		
X-9-2-3	3.0	790	638		Mam.tumor
X-9-2-4	3.0	870	718		
X-9-2-5	3.0	897	745		Ov.carcinoma
X-9-3-2	3.0	258	106		
X-9-3-3	3.0	639	487		Mam.adenoma Mam.adenoma
X-9-3-4	3.0	740	588		
X-9-3-5	3.0	1019	867		Ov.adenocarc./Mam.fibroadenoma Mam.adenoma
X-9-4-1	3.0	671	519		
X-9-4-2	3.0	839	687		
X-9-4-3	3.0	850	698		
X-9-4-4	3.0	870	718		
X-9-4-5	3.0	877	725		
X-9-5-1	5.0	627	475		
X-9-5-2	5.0	676	524		
X-9-5-3	5.0	744	592	Adenoma	Mal.lymphoma Mam.fibroadenoma Ov.tumor/Mam.fibroadenoma meta.Ov.adenocarcinoma
X-9-5-4	5.0	745	593		
X-9-5-5	5.0	877	725	Adenocarcinoma	Mam.fibroma
X-9-6-1	5.0	830	678		
X-9-6-2	5.0	860	708		Heptocellular Ca/Adr.carcinoma
X-9-6-3	5.0	975	823		
X-9-7-1	5.0	431	279		
X-9-7-2	5.0	436	284		
X-9-7-3	5.0	503	351	Adenocarcinoma	Mam.fibroadenoma
X-9-7-4	5.0	632	480		
X-9-7-5	5.0	908	756		
X-9-8-1	5.0	485	333		
X-9-8-2	5.0	543	391		Mam.fibroadenoma
X-9-8-3	5.0	653	501		
X-9-8-4	5.0	884	732		
X-9-8-5	5.0	892	740		

### **Group X-10**

[Age at the irradiation: 106 days/Total dose: 3.0-10.0 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung tumors	Other Tumors
X-10-1-1	5.0	623	517	Adenoma	
X-10-1-2	5.0	655	549		
X-10-1-3	5.0	736	630		
X-10-1-4	5.0	788	682		Mam.adenoma
X-10-1-5	5.0	861	755		Mam.fibroma
X-10-2-1	3.0	560	454	Adenocarcinoma	Ut.fibrosarcoma
X-10-2-2	3.0	662	556		
X-10-2-3	3.0	777	671		Mam.fibroadenoma
X-10-2-4	3.0	796	690		Mam.adenoma
X-10-2-5	3.0	995	889		Mam.adenoma
X-10-3-1	3.0	650	544		Mam.fibroadenoma
X-10-3-2	3.0	860	754		Mam.fibroadenoma
X-10-3-3	3.0	904	798		Mam.fibroadenoma
X-10-3-4	3.0	946	840		Mam.fibroma/Kid.fibrosarcoma
X-10-3-5	3.0	984	878		Mam.fibroadenoma
X-10-4-1	3.0	704	598		Mam.fibroma
X-10-4-2	3.0	731	625		Mam.fibroma
X-10-4-3	3.0	760	654		Mam.fibroma
X-10-4-4	3.0	959	853		
X-10-4-5	3.0	1014	908		
X-10-5-2	5.0	739	633	Squamous cell Ca Adenocarcinoma	Mam.fibroma
X-10-5-3	5.0	767	661		met.Ov.adenocarc./Mam.fibroma
X-10-5-4	5.0	795	689		
X-10-6-1	5.0	517	411		
X-10-6-2	5.0	714	608		
X-10-6-3	5.0	746	640		Adr.carcinoma
X-10-6-4	5.0	949	843		meta.Ov.fibrosarcoma
X-10-6-5	5.0	1063	957		
X-10-7-1	10	662	556	Squamous cell Ca	Mam.adenoma
X-10-7-2	10	676	570		
X-10-7-3	10	680	574	Adenocarcinoma	Mam.fibroma
X-10-7-4	10	762	656		
X-10-7-5	10	832	726	Adenoma	Mam.tumor
X-10-8-1	10	328	222	Adenoma	
X-10-8-2	10	543	437		Mam.fibroma
X-10-8-3	10	566	460		Mam.fibrosarcoma
X-10-8-4	10	580	474		
X-10-8-5	10	648	542		Mam.fibroadenoma
X-10-9-3	10	242	136	Adenocarcinoma	
X-10-9-4	10	585	479		
X-10-9-5	10	659	553		Mam.fibroma

### **Group X-11**

[Age at the irradiation: 100 days/Total dose: 3.0-10.0 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung tumors	Other Tumors
X-11-1-2	3.0	545	445	Adenocarcinoma  Adenoma  Adenoma	Adrenal tumor Mam.fibroma Mam.fibroadenoma  Ov.adenocarcinoma Mam.fibroadenoma Adrenal Ca/Osteosarcoma Mam.fibroma  meta.Osteofibrosarcoma
X-11-1-3	3.0	591	491		
X-11-1-4	3.0	855	755		
X-11-1-5	3.0	916	816		
X-11-2-1	3.0	461	361		
X-11-2-2	3.0	804	704		
X-11-2-3	3.0	838	738		
X-11-2-4	3.0	923	823		
X-11-2-5	3.0	982	882		
X-11-3-1	3.0	696	596		
X-11-3-2	3.0	720	620		
X-11-3-3	3.0	734	634		
X-11-3-4	3.0	748	648		
X-11-3-5	3.0	751	651		
X-11-4-1	5.0	451	351	Adenoma  Adenoma	Mam.adenocarcinoma          Mam.fibroma Mam.fibroadenoma
X-11-4-2	5.0	458	358		
X-11-4-3	5.0	512	412		
X-11-4-4	5.0	517	417		
X-11-4-5	5.0	645	545		
X-11-5-2	5.0	290	190		
X-11-5-3	5.0	295	195		
X-11-5-4	5.0	335	235		
X-11-5-5	5.0	563	463		
X-11-6-1	5.0	748	648		
X-11-6-2	5.0	832	732		
X-11-6-3	5.0	839	739		
X-11-6-4	5.0	846	746		
X-11-6-5	5.0	857	757		
X-11-7-2	10	293	193	Adenocarcinoma Adenocarcinoma Adenocarcinoma  Adenoma Adenoma   Adenoma	Lymphoid tumor meta.Ov.adenocarcinoma Mam.fibroadenoma
X-11-7-4	10	699	599		
X-11-7-5	10	744	644		
X-11-8-2	10	314	214		
X-11-8-3	10	429	329		
X-11-8-4	10	722	622		
X-11-8-5	10	784	684		
X-11-9-1	10	311	211		
X-11-9-2	10	367	267		
X-11-9-3	10	367	267		
X-11-9-4	10	370	270		
X-11-9-5	10	742	642		

### **Group X-12**

[Age at the irradiation: 108 days/Total dose: 3.0-10.0 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology		
				Lung tumors	Other Tumors	
X-12-1-1	3.0	402	294	Undif.carcinoma	Mam.fibroadenoma Mam.adenocarcinoma Mam.fibroma	
X-12-1-2	3.0	774	666			
X-12-1-3	3.0	821	713			
X-12-1-4	3.0	868	760			
X-12-1-5	3.0	973	865			
X-12-2-1	3.0	749	641	Adenoma	Mam.fibroma  Mam.adenocarcinoma	
X-12-2-2	3.0	882	774			
X-12-2-3	3.0	898	790			
X-12-2-4	3.0	1057	949			
X-12-3-1	3.0	588	480			
X-12-3-2	3.0	625	517	Adenocarcinoma	Mam.fibroadenoma meta.Ov.adenocarcinoma Stomach Sarcoma/Mam.fibroadenoma meta.Ov.adenocarcinoma Mam.fibroma	
X-12-3-3	3.0	828	720			
X-12-3-4	3.0	849	741			
X-12-3-5	3.0	955	847			
X-12-4-1	5.0	518	410			Adenocarcinoma
X-12-4-2	5.0	529	421			
X-12-4-3	5.0	539	431			
X-12-4-4	5.0	547	439			
X-12-4-5	5.0	875	767			
X-12-5-1	5.0	329	221	Mam.fibroma		
X-12-5-2	5.0	609	501			
X-12-5-3	5.0	648	540			
X-12-5-4	5.0	675	567			
X-12-5-5	5.0	905	797			
X-12-6-1	5.0	744	636	Ut.adenoma Mam.fibroma Mam.adenoma/Osteosarcoma Adrenal tumor		
X-12-6-2	5.0	759	651			
X-12-6-3	5.0	766	658			
X-12-6-4	5.0	787	679			
X-12-6-5	5.0	855	747			
X-12-7-1	10	522	414	Adenoma	meta.Ov.fibrosarcoma Mam.fibroma	
X-12-7-2	10	525	417			
X-12-7-3	10	532	424			
X-12-7-4	10	533	425			
X-12-7-5	10	609	501			
X-12-8-2	10	443	335		Adenoma	Ov.adenocarcinoma
X-12-8-3	10	490	382			
X-12-8-4	10	612	504			
X-12-8-5	10	667	559			
X-12-9-2	10	427	319			
X-12-9-3	10	567	459		Adenoma	
X-12-9-4	10	598	490			
X-12-9-5	10	689	581			

### Group X-13

[Age at the irradiation: 98 days/Total dose: 3.0-10.0 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung tumors	Other Tumors
X-13-1-2	3.0	695	597	Squamous Cell Ca	met.Ov.adenocarcinoma
X-13-1-3	3.0	794	696		
X-13-1-4	3.0	861	763		
X-13-1-5	3.0	912	814		Hepatocellular Ca
X-13-2-1	3.0	849	751		Mam.adenocarcinoma
X-13-2-2	3.0	889	791	Adenoma	Lymphoma
X-13-2-3	3.0	909	811		Mam.tumor
X-13-2-4	3.0	944	844		
X-13-2-5	3.0	971	873		Mam.fibroadenoma
X-13-3-1	3.0	763	665		Mam.fibrosarcoma
X-13-3-2	3.0	801	703		
X-13-3-3	3.0	874	776		Mam.fibroadenoma
X-13-3-4	3.0	924	826		meta.Osteosarcoma
X-13-3-5	3.0	965	867		Mam.fibroadenoma
X-13-4-1	5.0	426	328	Squamous Cell Ca	Salivary gl. adenocarcinoma
X-13-4-2	5.0	682	584	Adenocarcinoma	
X-13-4-3	5.0	827	729	Adenoma	
X-13-4-4	5.0	883	785	Adenoma	Mam.adenoma
X-13-4-5	5.0	926	828	Adenocarcinoma	Ov.adenocarcinoma
X-13-5-2	5.0	569	471		
X-13-5-3	5.0	696	598		Mam.fibroma
X-13-5-4	5.0	734	636		Mam.fibroadenoma
X-13-5-5	5.0	825	727		
X-13-6-1	5.0	475	377		
X-13-6-2	5.0	475	377		
X-13-6-3	5.0	651	553		Ov.adenocarcinoma
X-13-6-4	5.0	713	615		
X-13-6-5	5.0	741	643	Adenoma	Mam.fibroma
X-13-7-1	10	573	475	Adenoma	
X-13-7-2	10	573	475		
X-13-7-3	10	615	517		
X-13-7-4	10	621	523		
X-13-7-5	10	755	657	Adenocarcinoma	
X-13-8-1	10	583	485	Adenoma	
X-13-8-2	10	650	552		
X-13-8-3	10	710	612		
X-13-8-4	10	720	622	Adenocarcinoma	
X-13-8-5	10	828	730	Adenoma	
X-13-9-1	10	577	479		
X-13-9-2	10	591	493		
X-13-9-3	10	604	506	Adenocarcinoma	
X-13-9-4	10	607	509	Adenoma	
X-13-9-5	10	713	615	Adenoma	



### **Group X-14**

[Age at the irradiation: 101 days/Total dose: 1.0 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung tumors	Other Tumors
X-14-7-1	1.0	642	541	Adenoma	Mam.fibroadenoma meta.Ov.adenocarcinoma/Mam.fibroma
X-14-7-2	1.0	731	630		
X-14-7-3	1.0	902	801		
X-14-7-4	1.0	920	819		
X-14-7-5	1.0	961	860		
X-14-8-1	1.0	769	668	Adenocarcinoma	Mam.fibroma Mam.fibroadenoma Mam.adenoma Mam.tumor Mam.fibroma
X-14-8-2	1.0	853	752		
X-14-8-3	1.0	990	889		
X-14-8-4	1.0	993	892		
X-14-8-5	1.0	1010	909		
X-14-9-2	1.0	639	538	Squamous Cell Ca	Ov.tumor/Mam.tumor Kidney Ca
X-14-9-3	1.0	698	594		
X-14-9-4	1.0	757	656		
X-14-11-4	1.0	629	528	Adenoma	Mam.fibroma
X-14-11-5	1.0	723	622		
X-14-12-3	1.0	528	427		
X-14-12-4	1.0	650	549		
X-14-12-5	1.0	776	675		

### **Group X-15 (next page)**

[Age at the irradiation: 102 days/Total dose: 1.0 Gy]

Animal ID	Dose (Gy)	Survival (day)	Post-X (day)	Histopathology	
				Lung tumors	Other Tumors
X-15-1-1	1.0	606	504	Adenocarcinoma	
X-15-1-2	1.0	723	621		
X-15-1-3	1.0	807	705		Mam.fibroma
X-15-1-4	1.0	949	847		
X-15-1-5	1.0	989	887		Mam.fibroma
X-15-2-1	1.0	680	578		Mam.adenoma
X-15-2-2	1.0	931	829		Mam.fibroma
X-15-2-3	1.0	948	846		
X-15-2-4	1.0	969	867		
X-15-2-5	1.0	1072	970		Mam.fibrosarcoma
X-15-3-1	1.0	854	752		
X-15-3-2	1.0	893	791		
X-15-3-3	1.0	900	798		Ut.carcinoma
X-15-3-4	1.0	931	829		met.Ut.fibrosarcoma
X-15-4-1	1.0	673	571		
X-15-4-2	1.0	778	676		
X-15-4-3	1.0	840	738		
X-15-4-4	1.0	987	885		Mam.tumor
X-15-4-5	1.0	1039	937		meta.Mam.adenocarcinoma
X-15-5-1	1.0	711	609		
X-15-5-2	1.0	830	728		
X-15-5-3	1.0	884	782		Hepatocellular Ca/Mam.adenoma
X-15-5-4	1.0	959	857		Myeloid leukemia/Mam.tumor
X-15-5-5	1.0	1070	968		
X-15-6-1	1.0	554	452		
X-15-6-2	1.0	736	634		Subcutaneous tumor
X-15-6-3	1.0	788	686		
X-15-6-4	1.0	843	741		Mam.adenocarcinoma
X-15-6-5	1.0	1043	941		meta.Thyr.adenocarcinoma
X-15-7-1	1.0	665	563		
X-15-7-2	1.0	729	627		
X-15-7-3	1.0	784	682		Mam.fibroadenoma
X-15-7-4	1.0	835	733		meta.Ov.adenocarcinoma
X-15-7-5	1.0	938	836		
X-15-8-1	1.0	660	558	Hemangiosarcoma	
X-15-8-2	1.0	836	734		Mam.adenocarcinoma
X-15-8-3	1.0	910	808		
X-15-8-4	1.0	1075	973		
X-15-8-5	1.0	1102	1000		meta.Ov.adenocarcinoma/Mam.adenoma
X-15-9-1	1.0	687	585		Mam.fibroma
X-15-9-2	1.0	757	655		meta.Ov.adenocarcinoma
X-15-9-3	1.0	798	696		Mam.fibroadenoma
X-15-9-4	1.0	836	734		meta.Ov.adenocarcinoma
X-15-9-5	1.0	837	735		Mam.adenoma
X-15-10-1	1.0	434	332		
X-15-10-2	1.0	604	502		Mam.fibrosarcoma
X-15-10-3	1.0	622	520		Mam.fibroma
X-15-10-4	1.0	788	686		
X-15-10-5	1.0	872	770		meta.Ut.carcinoma
X-15-11-1	1.0	514	412		
X-15-11-2	1.0	696	594		
X-15-11-3	1.0	870	768		meta.Ut.carcinoma
X-15-11-4	1.0	952	850		
X-15-12-1	1.0	672	570		
X-15-12-2	1.0	812	710		
X-15-12-3	1.0	848	746		Ov.adenocarcinoma
X-15-12-4	1.0	913	811		
X-15-12-5	1.0	925	823		

### 3.2.Carcinogenesis in Mice

The experimental groups for lifetime risk evaluation on bone tumors, lymphomyeloid neoplasms and the other solid tumors specific or non-specific to injected, soluble  $^{239}\text{Pu}$  citrate solution into different strains of mice are the objects for summarization of pathological findings, mainly histopathology of fatal and incidental tumors, on individual animals which were only available for postmortem pathological examinations without cannibalism and autolysis of main organs. In addition, the experimental groups of the same strains of mice following either injections of MNU or whole-body  $\gamma$ -ray irradiation for comparisons with  $^{239}\text{Pu}$ -induced carcinogenesis, particularly in special reference to lymphomyeloid neoplasms. Information on the experimental regimens is also attached to each table list on pathological findings.

#### 3.2.1 Experimental Groups for Injections of $^{239}\text{Pu}$ Citrate Solution

##### Groups of Control Animals

The control groups of saline-injected animals as listed below correspond to each of experimental groups of  $^{239}\text{Pu}$ -injected animals, Groups IP1 to IP5 of C3H mice, and Groups IP7 to IP14 of three strains of mice, respectively.

##### Control Groups for Groups IP1-5 (C3H Mice)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Incidental Tumors
O-240-1	727	Thymic lymphoma	Ov.cystadenoma
O-240-2	727		
O-240-3	734	Malignant histiocytoma	
O-240-4	811		Pulm.adenocarcinoma
O-240-5	817	Lymphoma	
O-240-6	827	Hepatocellular carcinoma	SC fibrosarcoma
O-240-7	881	Ov.granulosa cell tumor	
O-240-8	921		Ov.cystadenoma
O-241-1	692	Hepatocellular carcinoma	
O-241-2	713	Hepatocellular carcinoma	
O-241-3	777	SC fibrosarcoma	Ov.granulosa cell tumor
O-241-4	804	Malignant histiocytoma	Pulm.adenoma
O-241-5	874	Malignant histiocytoma	Ov.granulosa cell tumor
O-241-6	885		
O-241-7	970		
O-241-8	971		
O-242-2	669		
O-242-3	756	Thymic lymphoma	Ov.cystadenoma
O-242-4	762		
O-242-5	810	Ov.granulosa cell tumor	Pulm.adenoma
O-242-6	845	SC fibrosarcoma	Ov.cystadenoma
O-242-7	848	Thymic lymphoma	
O-242-8	893	Lymphoma	Pulm.adenocarcinoma
O-242-9	934		Ov.cystadenoma
O-242-10	974	Ov.granulosa cell tumor	
O-249-1	674	Hepatocellular carcinoma	
O-249-2	785	Pulm.adenocarcinoma	
O-249-3	799	Abdominal adenocarcinoma	Ov.cystadenoma
O-249-4	800	SC fibrosarcoma	
O-249-5	812	Hepatocellular carcinoma	
O-249-6	827	Malignant histiocytoma	Ov.cystadenocarcinoma
O-249-7	841	Hepatocellular carcinoma	SC histiocytoma
O-249-8	903	Hepatocellular carcinoma	
O-249-9	927	SC fibrosarcoma	Ov.cystadenoma
O-249-10	991		

**Control Groups for Groups IP1-5 (C3H Mice; Cont'd)**

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Incidental Tumors
O-250-1	622	Pulm.adenocarcinoma	
O-250-2	656	Hepatocellular carcinoma	Pancreatic adenoma
O-250-3	722	Hepatocellular carcinoma	
O-250-4	753	Lymphoma	Pulm.adenocarcinoma
O-250-5	854	Hepatocellular carcinoma	Ov.cystadenocarcinoma
O-250-6	884	St.squamous cell carcinoma	
O-250-7	889	Pulm.adenocarcinoma	
O-250-8	921	Hepatocellular carcinoma	Ov.granulosa cell tumor
O-250-9	926	Malignant histiocyoma	Pulm.adenocarcinoma
O-250-10	928		Ov.cystadenoma
O-255-1	854	Hepatocellular carcinoma	
O-255-2	885	SC histiocyoma	Pulm.adenocarcinoma
O-255-3	906	Lymphoma	Ov.cystadenocarcinoma
O-255-4	946	Hepatocellular carcinoma	Ov.fibroadenocarcinoma
O-255-5	972		
O-256-1	750		
O-256-2	777		
O-256-3	789		
O-256-4	795	Abdominal tumor	
O-256-5	807	Lymphoma	
O-256-6	871		
O-256-7	889	SC myxoma	
O-256-8	894	Malignant histiocyoma	
O-256-9	952		
O-256-10	963	SC histiocyoma	

**Control Groups for Groups IP7 (C3H)**

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Incidental Tumors
IP7-1-Ct1-1	672		
IP7-1-Ct1-2	683	Hepatocellular carcinoma	
IP7-1-Ct1-3	737		Pulm.adenocarcinoma
IP7-1-Ct1-4	755	Lymphoma	
IP7-1-Ct1-5	772	Lymphoma	Ov.cystadenoma
IP7-1-Ct1-6	853	Hepatocellular carcinoma	
IP7-1-Ct1-7	882		Ov.adenocarcinoma
IP7-1-Ct1-8	895		
IP7-1-Ct1-9	896	Hepatocellyular carcinoma	
IP7-1-Ct2-1	424	Thymic lymphoma	
IP7-1-Ct2-2	650		
IP7-1-Ct2-3	745	Liver fibrosarcoma	
IP7-1-Ct2-4	757	Abdominal sarcoma	Pulm.Adenocarcinoma
IP7-1-Ct2-5	837	SC fibrosarcoma	
IP7-1-Ct2-6	873		Pulm.adenocarcinoma
IP7-1-Ct2-7	913		
IP7-1-Ct2-8	932		
IP7-1-Ct2-9	942		
IP7-1-Ct2-10	945		

### Control Groups for Groups IP7 (C57)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Incidental Tumors
IP7-2-Ct1-1	383	Lymphoma	SC fibrosarcoma local.lymphoma
IP7-2-Ct1-2	528		
IP7-2-Ct1-3	583		
IP7-2-Ct1-4	724		
IP7-2-Ct1-5	802		
IP7-2-Ct1-6	803		
IP7-2-Ct1-7	912		
IP7-2-Ct1-8	944	Lymphoma	SC fibrosarcoma
IP7-2-Ct1-9	965	Lymphoma	
IP7-2-Ct1-10	984		
IP7-2-Ct2-1	402		
IP7-2-Ct2-2	601	Thymic lymphoma	
IP7-2-Ct2-3	625		
IP7-2-Ct2-4	734		
IP7-2-Ct2-5	789	Myeloid leukemia	
IP7-2-Ct2-6	849	T-cell lymphoma	
IP7-2-Ct2-7	868	Lymphoma	
IP7-2-Ct2-8	932		
IP7-2-Ct2-9	940		
IP7-2-Ct2-10	959	Hepatocellular carcinoma	

### Control Groups for Groups IP7 (BC3)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Incidental Tumors
IP7-3-Ct1-1	530	Lymphoma	local hepatocellular Ca
IP7-3-Ct1-2	550		
IP7-3-Ct1-3	595	Myeloid leukemia	
IP7-3-Ct1-4	638	Lymphoma	
IP7-3-Ct1-5	674		
IP7-3-Ct1-6	769	Lymphoma	
IP7-3-Ct1-7	815		
IP7-3-Ct1-8	870	Lymphoma	
IP7-3-Ct1-9	897		
IP7-3-Ct1-10	980	Hepatocellular carcinoma	
IP7-3-Ct2-1	671		Pulm.adenocarcinoma Uterus carcinoma  Pulm.adenoma
IP7-3-Ct2-2	731		
IP7-3-Ct2-3	745	Abdominal sarcoma	
IP7-3-Ct2-4	759		
IP7-3-Ct2-5	827	SC fibrosarcoma	
IP7-3-Ct2-6	854	Mam.adenocarcinoma	
IP7-3-Ct2-7	891	SC fibrosarcoma	
IP7-3-Ct2-8	899	Thymic lymphoma	
IP7-3-Ct2-9	928	Abdominal tumor	
IP7-3-Ct2-10	1003	SC fibrosarcoma	

### Control Groups for Groups IP8 (C3H)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Incidental Tumors
IP8-1-Ct1-1	387		
IP8-1-Ct1-2	605	Mam.adenocarcinoma	Pulm.adenocarcinoma
IP8-1-Ct1-3	699		
IP8-1-Ct1-4	713	Pulm.adenocarcinoma	
IP8-1-Ct1-5	848		Ov.cystadenoma
IP8-1-Ct1-6	861	Ov.fibroadenocarcinoma	
IP8-1-Ct1-7	875	SC fibrosarcoma	
IP8-1-Ct1-8	882	Lymphoma	
IP8-1-Ct1-9	891		
IP8-1-Ct1-10	896		Uterus fibrosarcoma
IP8-1-Ct2-1	366		
IP8-1-Ct2-2	665	Hepatocellular carcinoma	
IP8-1-Ct2-3	673		
IP8-1-Ct2-4	755	Thymic lymphoma	
IP8-1-Ct2-5	810	SC basal cell carcinoma	
IP8-1-Ct2-6	837		
IP8-1-Ct2-7	864	SC adenocarcinoma	
IP8-1-Ct2-8	870		
IP8-1-Ct2-9	905	SC fibrosarcoma	
IP8-1-Ct2-10	926		

### Control Groups for Groups IP8 (C57)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Incidental Tumors
IP8-2-Ct1-1	616		
IP8-2-Ct1-2	638		
IP8-2-Ct1-3	658	Lymphoma	
IP8-2-Ct1-4	667	Thymic lymphoma	Hepatocellular carcinoma
IP8-2-Ct1-5	668		
IP8-2-Ct1-6	670	Thymic lymphoma	
IP8-2-Ct1-7	678	Myeloid leukemia	
IP8-2-Ct1-8	767	Lymphoma	
IP8-2-Ct1-9	815	Lymphoma	
IP8-2-Ct1-10	885	Hepatocellular carcinoma	
IP8-2-Ct2-1	533		
IP8-2-Ct2-2	641		
IP8-2-Ct2-3	641	Abdominal lymphoma	
IP8-2-Ct2-4	736	Thymic lymphoma	
IP8-2-Ct2-5	748		
IP8-2-Ct2-6	793	Histiocytic lymphoma	
IP8-2-Ct2-7	795		
IP8-2-Ct2-8	828	Thymic lymphoma	
IP8-2-Ct2-9	829		
IP8-2-Ct2-10	833		

### Control Groups for Groups IP8 (BC3)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Incidental Tumors
IP8-3-Ct1-1	529	Myeloid leukemia	
IP8-3-Ct1-2	665		
IP8-3-Ct1-3	724	Myeloid leukemia	
IP8-3-Ct1-4	731		
IP8-3-Ct1-5	739	Thymic lymphoma	
IP8-3-Ct1-6	749	Lymphoma	
IP8-3-Ct1-7	757		
IP8-3-Ct1-8	816	Osteofibrosarcoma	
IP8-3-Ct1-9	994	Lymphoma	
IP8-3-Ct1-10	994	SC fibrosarcoma	
IP8-3-Ct2-1	329		Osteoma
IP8-3-Ct2-2	521	SC fibroadenocarcinoma	
IP8-3-Ct2-3	558	Lymphoma	
IP8-3-Ct2-4	609	Lymphoma	
IP8-3-Ct2-5	749		
IP8-3-Ct2-6	788		Pulm.AC/Ov.CA
IP8-3-Ct2-7	893		
IP8-3-Ct2-8	981	Lymphoma	
IP8-3-Ct2-9	1014		
IP8-3-Ct2-10	1026		

### Control Groups for Groups IP9 (C3H)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Incidental Tumors
IP9-1-Ct1-1	462	Thymic lymphoma	
IP9-1-Ct1-2	486		
IP9-1-Ct1-3	641		
IP9-1-Ct1-4	678	SC Sarcoma	Ov.cystadenocarcinoma
IP9-1-Ct1-5	693		Adrenal tumor
IP9-1-Ct1-6	709	Thymic lymphoma	
IP9-1-Ct1-7	753		
IP9-1-Ct1-8	817		
IP9-1-Ct1-9	824		
IP9-1-Ct1-10	860		
IP9-1-Ct2-1	640		
IP9-1-Ct2-2	690	Lymphoma	
IP9-1-Ct2-3	705		Ov.cystadenoma
IP9-1-Ct2-4	745	Thymic lymphoma	
IP9-1-Ct2-5	779		
IP9-1-Ct2-6	781	Lymphoma	
IP9-1-Ct2-7	797	SC fibrosarcoma	
IP9-1-Ct2-8	807		
IP9-1-Ct2-9	813	SC fibrosarcoma	Ov.cystadenoma
IP9-1-Ct2-10	838		

### Control Groups for Groups IP9 (C57)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Incidental Tumors
IP9-2-Ct1-1	390		
IP9-2-Ct1-2	391		
IP9-2-Ct1-3	407		
IP9-2-Ct1-4	412		
IP9-2-Ct1-5	423		
IP9-2-Ct1-6	443		
IP9-2-Ct1-7	489		
IP9-2-Ct1-8	515		
IP9-2-Ct1-9	625		
IP9-2-Ct1-10	760	SC sarcoma	
IP9-2-Ct2-1	352		
IP9-2-Ct2-2	382	?	
IP9-2-Ct2-3	397	Thymic lymphoma	
IP9-2-Ct2-4	419		
IP9-2-Ct2-5	449		
IP9-2-Ct2-6	621		
IP9-2-Ct2-7	719	Histiocytic lymphoma	
IP9-2-Ct2-8	726		
IP9-2-Ct2-9	809		
IP9-2-Ct2-10	839		

### Control Groups for Groups IP9 (BC3)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Incidental Tumors
IP9-3-Ct1-1	370		
IP9-3-Ct1-2	453	Lymphoma	
IP9-3-Ct1-3	576		
IP9-3-Ct1-4	597	Lymphoma	
IP9-3-Ct1-5	627		
IP9-3-Ct1-6	733	SC fibrosarcoma	
IP9-3-Ct1-7	794	Lymphoma	
IP9-3-Ct1-8	859	SC fibrosarcoma	
IP9-3-Ct1-9	883	SC fibrosarcoma	
IP9-3-Ct1-10	892	SC fibrosarcoma	
IP9-3-Ct2-1	560	Thymic lymphoma	
IP9-3-Ct2-2	606	Myeloid leukemia	
IP9-3-Ct2-3	654	Myeloid leukemia	
IP9-3-Ct2-4	661	Lymphoma	
IP9-3-Ct2-5	674	Thymic lymphoma	
IP9-3-Ct2-6	677	SC fibrosarcoma	Ov.cystadenoma
IP9-3-Ct2-7	782	SC fibrosarcoma	
IP9-3-Ct2-8	791	Lymphoma	
IP9-3-Ct2-9	798	Lymphoma	
IP9-3-Ct2-10	979	Lymphoma	



### Control Groups for Groups IP12 (C3H)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Incidental Tumors
IP12-Ct-1	362	SC fibrosarcoma	Ov.tumor
IP12-Ct-2	487		
IP12-Ct-3	500		
IP12-Ct-4	503		
IP12-Ct-5	630	SC Adenocarcinoma	Histiocytoma
IP12-Ct-6	632	SC Adenocarcinoma	
IP12-Ct-7	666		P.Adenoma
IP12-Ct-8	773		
IP12-Ct-9	805		

### Control Groups for Groups IP13 (C57)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Incidental Tumors
IP13-Ct-1	441	Lymphoma	local.Lymphoma
IP13-Ct-2	527	Leukemic Lymphoma	
IP13-Ct-3	644	Lymphoma	
IP13-Ct-4	648		
IP13-Ct-5	649		
IP13-Ct-6	652		
IP13-Ct-7	727	HCC	
IP13-Ct-8	799	HCC	
IP13-Ct-9	802		

### Control Groups for Groups IP14 (BC3)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Incidental Tumors
IP14-Ct-1	569	MAC	Hepatocellular Ca/Thyroid Ca
IP14-Ct-2	740	Myeloid Leukemia	
IP14-Ct-3	754	Thymic Lymphoma	
IP14-Ct-4	762		
IP14-Ct-5	770	SC Fibrosarcoma	
IP14-Ct-6	817		
IP14-Ct-7	835	Myeloid Leukemia	
IP14-Ct-8	838	T-Lymphoma	
IP14-Ct-9	838		

### **Groups of $^{239}\text{Pu}$ -Injected Animals**

The experimental groups of  $^{239}\text{Pu}$ -injected animals as listed below include the Groups IP1 to IP5 of C3H mice and IP7 to IP14 of three strains of mice, and the information on the experimental regimens including the age of animals at injections and the injected doses, is attached to the head of the table for each group, respectively

**Group IP1 (C3H)**

[Age at injections: 98 days/Injected doses: 500-10000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP1-1-1	10900	220	26.0	Leukemic lymphoma	
IP1-1-2	"	250	29.1	Malignant histiocytoma	
IP1-1-3	"	270	31.2		
IP1-1-4	"	360	40.0		
IP1-1-5	"	383	42.1		
IP1-1-6	"	383	42.1	Osteosarcoma	
IP1-1-7	"	386	42.3		
IP1-1-8	"	406	44.2		
IP1-1-9	"	438	47.0		
IP1-1-10	"	438	47.0	Osteosarcoma	
IP1-2-1	5350	190	11.2	Lymphoma	
IP1-2-2	"	253	14.4	Osteosarcoma	
IP1-2-3	"	300	16.8	Osteosarcoma	
IP1-2-4	"	315	17.5		
IP1-2-5	"	349	19.1		
IP1-2-6	"	365	19.8		
IP1-2-7	"	365	19.8	Leukemic lymphoma	
IP1-2-8	"	375	20.3	Leukemic Lymphoma	
IP1-2-9	"	427	22.6	Osteosarcoma	
IP1-3-1	1120	290	3.40	Osteosarcoma	
IP1-3-2	"	344	3.94		
IP1-3-3	"	369	4.18		
IP1-3-4	"	416	4.62		
IP1-3-5	"	432	4.76	Malignant histiocytoma	
IP1-3-6	"	433	4.77		
IP1-3-7	"	461	5.02		
IP1-3-8	"	536	5.65		
IP1-3-9	"	556	5.81	Osteosarcoma	
IP1-3-10	"	605	6.19		
IP1-4-1	589	470	2.69	Ov.cystadenoma	
IP1-4-2	"	470	2.69		Osteosarcoma
IP1-4-3	"	508	2.86		Osteosarcoma
IP1-4-4	"	543	3.01		
IP1-4-5	"	559	3.07		Osteosarcoma
IP1-4-6	"	586	3.19		Leukemic lymphoma
IP1-4-7	"	622	3.33		
IP1-4-8	"	638	3.39		Osteosarcoma
IP1-4-9	"	651	3.44		Osteosarcoma
IP1-4-10	"	661	3.48		

### **Group IP2 (C3H)**

[Age at injections: 107 days/Injected doses: 500-10000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP2-1-1	11600	256	31.7	Splenic lymphoma Intestinal lymphoma  Osteosarcoma	
IP2-1-2	"	330	39.5		
IP2-1-3	"	338	40.3		
IP2-1-4	"	355	42.0		
IP2-1-5	"	360	42.5		
IP2-1-6	"	388	45.2		
IP2-1-7	"	398	46.2		
IP2-1-8	"	466	52.5		
IP2-1-9	"	468	52.7		
IP2-2-1	6050	300	19.0	Leukemic lymphoma	
IP2-2-2	"	314	19.7	Leukemic lymphoma	
IP2-2-3	"	330	20.6		
IP2-2-4	"	338	21.0		
IP2-2-5	"	355	21.9	Osteosarcoma	
IP2-2-6	"	356	22.0	Osteosarcoma	
IP2-2-7	"	406	24.5	Osteosarcoma	
IP2-2-8	"	441	26.2		
IP2-3-1	1540	322	5.13	Osteosarcoma Osteosarcoma Osteosarcoma Osteosarcoma Osteosarcoma Osteosarcoma Osteosarcoma Osteosarcoma Osteosarcoma Cholangiocarcinoma	Ov.cystadenocarcinoma
IP2-3-2	"	322	5.13		
IP2-3-3	"	338	5.35		
IP2-3-4	"	396	6.11		
IP2-3-5	"	406	6.24		
IP2-3-6	"	416	6.36		
IP2-3-7	"	416	6.36		
IP2-3-8	"	437	6.62		
IP2-3-9	"	523	7.64		
IP2-3-10	"	583	8.30		
IP2-4-1	727	294	2.24	Hepatocellular carcinoma Osteosarcoma Osteosarcoma Osteosarcoma	Ov.Cystadenoma  Ov.cystadenoma
IP2-4-2	"	310	2.34		
IP2-4-3	"	494	3.45		
IP2-4-4	"	538	3.68		
IP2-4-5	"	540	3.69		
IP2-4-6	"	591	3.96		
IP2-4-7	"	602	4.01		
IP2-4-8	"	640	4.20		
IP2-4-9	"	654	4.26		
IP2-4-10	"	661	4.29		

### Group IP3 (C3H)

[Age at injections: 90 days/Injected doses: 500-10000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP3-1-1	10600	233	26.6	Leukemic lymphoma	
IP3-1-2	"	254	28.7		
IP3-1-3	"	341	37.1		
IP3-1-4	"	367	39.5		
IP3-1-5	"	377	40.4		
IP3-1-6	"	381	40.7	Osteosarcoma	
IP3-1-7	"	402	42.6		
IP3-1-8	"	430	45.0		
IP3-1-9	"	441	45.9		
IP3-1-10	"	452	46.8	Osteosarcoma	
IP3-2-1	5160	284	15.4		
IP3-2-2	"	297	16.0	Osteosarcoma	
IP3-2-3	"	311	16.7	Osteosarcoma	
IP3-2-4	"	339	18.0	Osteosarcoma	
IP3-2-5	"	374	19.5		
IP3-2-6	"	383	19.9		
IP3-2-7	"	416	21.3	Osteosarcoma	
IP3-2-8	"	416	21.3	Osteosarcoma	
IP3-2-9	"	416	21.3	Osteosarcoma	
IP3-2-10	"	452	22.8	Osteosarcoma	
IP3-3-1	1540	332	5.27	Osteosarcoma	
IP3-3-2	"	340	5.38	Osteosarcoma	
IP3-3-3	"	387	5.99		
IP3-3-4	"	432	6.56	Osteosarcoma	
IP3-3-5	"	447	6.75	Osteosarcoma	
IP3-3-6	"	452	6.80	Osteosarcoma	
IP3-3-7	"	517	7.57	Osteosarcoma	
IP3-3-8	"	525	7.66	Osteoma	
IP3-3-9	"	525	7.66	Osteosarcoma	
IP3-3-10	"	525	7.66	Osteosarcoma	
IP3-4-1	580	311	1.88		
IP3-4-2	"	389	2.27	Osteosarcoma	
IP3-4-3	"	447	2.54		
IP3-4-4	"	475	2.67	Osteosarcoma	Ov.cystadenoma
IP3-4-5	"	495	2.75	Leukemic lymphoma	
IP3-4-6	"	532	2.91		
IP3-4-7	"	532	2.91		
IP3-4-8	"	564	3.05		Ov.cystadenoma
IP3-4-9	"	581	3.12	Osteosarcoma	
IP3-4-10	"	680	3.50		Ov.cystadenoma
IP3-4-11	"	688	3.53		Ov.cystadenoma

### Group IP4 (C3H)

[Age at injections: 106 days/Injected doses: 10-100 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP4-1-1	10.7	339	0.037		local osteoma
IP4-1-2	"	461	0.048	Pulm.adenocarcinoma	
IP4-1-3	"	626	0.061	Thymic lymphoma	
IP4-1-4	"	642	0.062	Lymphoma	
IP4-1-5	"	661	0.063	SC fibrosarcoma	
IP4-1-6	"	740	0.068		Ov.cystadenoma
IP4-1-7	"	752	0.069		Ov.fibroadenocarcinoma
IP4-1-8	"	818	0.073	Hepatocellular carcinoma	Ov.cystadenoma
IP4-1-9	"	852	0.075		SC tumor
IP4-1-10	"	867	0.076		
IP4-2-1	"	444	0.046		
IP4-2-2	"	528	0.053		
IP4-2-3	"	538	0.054	Hepatocellular carcinoma	
IP4-2-4	"	585	0.058	Mam.adenocarcinoma	Pulm.adenoma
IP4-2-5	"	670	0.064		
IP4-2-6	"	773	0.071		
IP4-2-7	"	804	0.072		Pulm.adenocarcinoma
IP4-2-8	"	844	0.075	Hepatocellular carcinoma	Ov.adenocarcinoma
IP4-2-9	"	871	0.076	Ovary sarcoma	SC histiocytoma
IP4-2-10	"	881	0.077	Lymphoma	
IP4-3-1	110	458	0.491	Malignant histiocytoma	Ov.cystadenoma
IP4-3-2	"	577	0.588		SC fibrosarcoma
IP4-3-3	"	689	0.670		
IP4-3-4	"	703	0.680	Malignant histiocytoma	
IP4-3-5	"	747	0.709	Osteosarcoma	
IP4-3-6	"	795	0.740	Lymphoma	Pulm.adenocarcinoma
IP4-3-7	"	809	0.748	Lymphoma	Ov.cystadenocarcinoma
IP4-3-8	"	868	0.784	Osteosarcoma	
IP4-3-9	"	883	0.793		
IP4-3-10	"	906	0.806		Pulm.adenocarcinoma
IP4-4-1	"	650	0.642	St.squamous cell carcinoma	
IP4-4-2	"	684	0.666	Hepatocellular carcinoma	
IP4-4-3	"	696	0.675	Hepatocellular carcinoma	
IP4-4-4	"	738	0.703		
IP4-4-5	"	801	0.744	Hepatocellular carcinoma	
IP4-4-6	"	824	0.758		Ov.fibroadenocarcinoma
IP4-4-7	"	833	0.763	Lymphoma	Ov.adenoma
IP4-4-8	"	839	0.767	SC fibrosarcoma	
IP4-4-9	"	857	0.778		Ov.adenocarcinoma
IP4-4-10	"	869	0.785		Uterus tumor
IP4-5-1	"	732	0.699	Ov.granulosa cell tumor	
IP4-5-2	"	769	0.723	Osteosarcoma	
IP4-5-3	"	776	0.728	Malignant histiocytoma	local osteoma
IP4-5-4	"	777	0.728		Ov.cystadenocarcinoma
IP4-5-5	"	781	0.731	Malignant histiocytoma	
IP4-5-6	"	781	0.731		
IP4-5-7	"	788	0.735	Malignant histiocytoma	
IP4-5-8	"	789	0.736		
IP4-5-9	"	874	0.787	Osteosarcoma	SC epidermoid carcinoma
IP4-5-10	"	885	0.794		Ov.adenocarcinoma

### **Group IP5 (C3H)**

[Age at injections: 89 days/Injected doses: 10-100 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP5-1-1	10.7	549	0.055		Uterus adenocarcinoma
IP5-1-2	"	591	0.058		Uterus tumor
IP5-1-3	"	654	0.063		
IP5-1-4	"	815	0.073	Hepatocellular carcinoma	
IP5-1-5	"	819	0.073	Lymphoma	
IP5-1-6	"	836	0.074		Pulm.adenoma
IP5-1-7	"	836	0.074	Hepatocellular carcinoma	
IP5-1-8	"	850	0.075		
IP5-1-9	"	911	0.079		Pulm.adenocarcinoma
IP5-2-1	"	563	0.056		Pulm.adenocarcinoma
IP5-2-2	"	565	0.056		
IP5-2-3	"	565	0.056		
IP5-2-4	"	565	0.056		
IP5-2-5	"	675	0.064		
IP5-2-6	"	745	0.069	Hepatocellular carcinoma	
IP5-2-7	"	811	0.073		
IP5-2-8	"	850	0.075	SC fibrosarcoma	
IP5-2-9	"	883	0.077		
IP5-3-1	"	647	0.062		
IP5-3-2	"	679	0.064	SC histiocytoma	Liver hemangioma
IP5-3-3	"	773	0.071		
IP5-3-4	"	778	0.071	Hepatocellular carcinoma	
IP5-3-5	"	780	0.071		Pulm.adenocarcinoma
IP5-3-6	"	787	0.071	Hepatocellular carcinoma	
IP5-3-7	"	790	0.072		
IP5-3-8	"	859	0.076	Kidney adenocarcinoma	
IP5-3-9	"	861	0.076	Malignant histiocytoma	
IP5-3-10	"	890	0.077		
IP5-4-1	111	395	0.440		
IP5-4-2	"	672	0.664	Splenic lymphoma	
IP5-4-3	"	689	0.676		
IP5-4-4	"	703	0.686		
IP5-4-5	"	710	0.691		SC fibrosarcoma
IP5-4-6	"	724	0.700		
IP5-4-7	"	789	0.743	Malignant histiocytoma	Pulm.adenocarcinoma
IP5-4-8	"	791	0.744		Uterus tumor
IP5-4-9	"	832	0.769		
IP5-4-10	"	840	0.774		
IP5-5-1	"	137	0.171		
IP5-5-2	"	284	0.332		
IP5-5-3	"	514	0.543	Osteosarcoma	
IP5-5-4	"	675	0.666	St.carcinoma	
IP5-5-5	"	739	0.710	Malignant histiocytoma	
IP5-5-6	"	752	0.719		Ov.cystadenoma
IP5-5-7	"	797	0.748		
IP5-5-8	"	801	0.750	Hepatocellular carcinoma	
IP5-5-9	"	851	0.781		Pulm.adenoma
IP5-5-10	"	933	0.828		

**Group IP7 (C3H)**

[Age at injections: 70 days/Injected doses: 100 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP7-1-1-1	100	720	0.63	Hepatocellular carcinoma	
IP7-1-1-2	"	721	0.63		
IP7-1-1-3	"	754	0.65	Rib bone fibrosarcoma	
IP7-1-1-4	"	791	0.67		
IP7-1-1-5	"	802	0.68	Granulosa cell tumor	local.hepatocellular Ca
IP7-1-1-6	"	825	0.69	SC fibrosarcoma	Osteoma /Ov.CAC
IP7-1-1-7	"	830	0.69		
IP7-1-1-8	"	845	0.70	Osteosarcoma	
IP7-1-1-9	"	908	0.73	SC fibrosarcoma	
IP7-1-1-10	"	938	0.75		Ov.cystadenoma
IP7-1-2-1	"	710	0.62		local.osteoma
IP7-1-2-2	"	739	0.64	Hepatocellular carcinoma	
IP7-1-2-3	"	741	0.64		local.osteosarcoma
IP7-1-2-4	"	768	0.66	SC fibrosarcoma	local hepatocellular Ca
IP7-1-2-5	"	777	0.66		
IP7-1-2-6	"	778	0.66	Fibrosarcoma	
IP7-1-2-7	"	781	0.66	Osteosarcoma	
IP7-1-2-8	"	800	0.67	SC fibrosarcoma	Ov.adenoma
IP7-1-2-9	"	933	0.74		
IP7-1-2-10	"	952	0.75	Hemangiosarcoma	Osteoma
IP7-1-3-1	"	651	0.58		Pulm.adenocarcinoma
IP7-1-3-2	"	653	0.58		
IP7-1-3-3	"	771	0.66	Osteosarcoma	
IP7-1-3-4	"	775	0.66		local HCC/Ov.CA
IP7-1-3-5	"	865	0.71		
IP7-1-3-6	"	866	0.71		
IP7-1-3-7	"	866	0.71	SC fibrosarcoma	
IP7-1-3-8	"	867	0.71	Hepatocellular carcinoma	
IP7-1-3-9	"	890	0.72		Ov.adenocarcinoma
IP7-1-3-10	"	942	0.75	SC fibrosarcoma	Ov.cystadenoma

### **Group IP7 (C57)**

[Age at injections: 87 days/Injected doses: 100 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology		
				Fatal Tumors	Incidental Tumors	
IP7-2-1-1	100	653	0.58	Lymphoma	Osteoma	
IP7-2-1-2	"	659	0.59			
IP7-2-1-3	"	681	0.60			
IP7-2-1-4	"	722	0.63			
IP7-2-1-5	"	724	0.63	Lymphoma		
IP7-2-1-6	"	740	0.64			
IP7-2-1-7	"	764	0.65			
IP7-2-1-8	"	807	0.68			
IP7-2-1-9	"	852	0.70	Osteosarcoma		
IP7-2-1-10	"	917	0.74	Lymphoma		
IP7-2-2-1	"	567	0.53			
IP7-2-2-2	"	611	0.56			
IP7-2-2-3	"	655	0.59			
IP7-2-2-4	"	703	0.62	Pulm.adenocarcinoma		
IP7-2-2-5	"	704	0.62			
IP7-2-2-6	"	754	0.65		Lymphoma	
IP7-2-2-7	"	822	0.69			
IP7-2-2-8	"	829	0.69			Thymic lymphoma
IP7-2-2-9	"	881	0.72			
IP7-2-2-10	"	924	0.74		Osteosarcoma	
IP7-2-3-1	"	480	0.46		Leukemic lymphoma	
IP7-2-3-2	"	594	0.54		Lymphoma	
IP7-2-3-3	"	615	0.56			
IP7-2-3-4	"	669	0.59			
IP7-2-3-5	"	712	0.62			
IP7-2-3-6	"	717	0.63			
IP7-2-3-7	"	756	0.65	Thymic lymphoma		
IP7-2-3-8	"	761	0.65			Abdominal sarcoma
IP7-2-3-9	"	766	0.65			
IP7-2-3-10	"	782	0.66			



**Group IP7 (BC3)**

[Age at injections: 87 days/Injected doses: 100 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP7-3-1-1	100	614	0.56		
IP7-3-1-2	"	620	0.56	Thymic lymphoma	
IP7-3-1-3	"	642	0.58	Osteosarcoma	
IP7-3-1-4	"	649	0.58		SC fibrosarcoma
IP7-3-1-5	"	696	0.61	Myeloid leukemia	
IP7-3-1-6	"	780	0.66	Osteosarcoma	Pulm.adenoma
IP7-3-1-7	"	795	0.67	SC fibrosarcoma	
IP7-3-1-8	"	856	0.70		
IP7-3-1-9	"	867	0.71	Osteosarcoma	
IP7-3-1-10	"	979	0.77	Lymphoma	SC fibrosarcoma
IP7-3-2-1	"	602	0.55	Lymphoma	
IP7-3-2-2	"	632	0.57		
IP7-3-2-3	"	659	0.59	local.lymphoma	
IP7-3-2-4	"	667	0.59	Osteofibrosarcoma	Ov.cystadenoma
IP7-3-2-5	"	692	0.61	Osteosarcoma	Ov.cystadenoma
IP7-3-2-6	"	763	0.65	Histiocytic lymphoma	
IP7-3-2-7	"	819	0.68	Ov.fibrosarcoma	
IP7-3-2-8	"	857	0.71	Osteosarcoma	
IP7-3-2-9	"	961	0.76	Lymphoma	
IP7-3-3-1	"	511	0.49	Thymic lymphoma	
IP7-3-3-2	"	596	0.55		SC fibrosarcoma
IP7-3-3-3	"	639	0.58		
IP7-3-3-4	"	699	0.61		SC fibrosarcoma
IP7-3-3-5	"	704	0.62		Ov.cystadenoma
IP7-3-3-6	"	711	0.62	Pulm.adenocarcinom	
IP7-3-3-7	"	715	0.62		local.osteosarcoma
IP7-3-3-8	"	725	0.63		local.osteosarcoma
IP7-3-3-9	"	728	0.63		
IP7-3-3-10	"	792	0.67	Osteofibrosarcoma	
IP7-3-3-11	"	822	0.69	Mam.adenocarcinoma	
IP7-3-3-12	"	835	0.69	Mam.adenocarcinoma	

**Group IP8 (C3H)**

[Age at injections: 105 days/Injected doses: 500 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP8-1-1-1	500	455	2.22	Osteosarcoma	
IP8-1-1-2	"	475	2.30		
IP8-1-1-3	"	532	2.51		local.osteosarcoma
IP8-1-1-4	"	571	2.65		
IP8-1-1-5	"	574	2.66		
IP8-1-1-6	"	577	2.67	Osteosarcoma	
IP8-1-1-7	"	609	2.78		Osteoma
IP8-1-1-8	"	627	2.84	Osteosarcoma	
IP8-1-1-9	"	632	2.86		local.osteosarcoma
IP8-1-1-10	"	669	2.98	Osteosarcoma	
IP8-1-2-1	"	527	2.49		local.osteosarcoma
IP8-1-2-2	"	531	2.51	Osteosarcoma	
IP8-1-2-3	"	566	2.63		
IP8-1-2-4	"	576	2.67		local.osteosarcoma
IP8-1-2-5	"	580	2.68		local.osteosarcoma
IP8-1-2-6	"	670	2.98		SC adenocarcinoma
IP8-1-2-7	"	677	3.01	Osteosarcoma	Hepatocellular carcinoma
IP8-1-2-8	"	698	3.07		Pulm.adenoma
IP8-1-2-9	"	825	3.45		
IP8-1-2-10	"	854	3.53		
IP8-1-3-1	"	413	2.05	Osteosarcoma	
IP8-1-3-2	"	423	2.09	Osteosarcoma	
IP8-1-3-3	"	443	2.17	Osteosarcoma	
IP8-1-3-4	"	501	2.40		
IP8-1-3-5	"	531	2.51	Osteosarcoma	
IP8-1-3-6	"	576	2.67		
IP8-1-3-7	"	585	2.70	Osteosarcoma	
IP8-1-3-8	"	648	2.91	Osteosarcoma	
IP8-1-3-9	"	679	3.01		
IP8-1-3-10		739	3.20	Osteosarcoma	

### **Group IP8 (C57)**

[Age at injections: 126 days/Injected doses: 500 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP8-2-1-1	500	435	2.14	local.lymphoma	
IP8-2-1-2	"	500	2.39	Lymphoma	
IP8-2-1-3	"	549	2.57	Abdominal sarcoma	
IP8-2-1-4	"	593	2.73		local.osteoma
IP8-2-1-5	"	622	2.83	Abdominal lymphoma	
IP8-2-1-6	"	625	2.84		Pulm.adenocarcinoma
IP8-2-1-7	"	681	3.02	Lymphoma	
IP8-2-1-8	"	682	3.02	Myeloid leukemia	
IP8-2-1-9	"	701	3.08		
IP8-2-1-10	"	720	3.14		
IP8-2-2-1	"	364	1.85		Pulm.adenocarcinoma
IP8-2-2-2	"	536	2.53		
IP8-2-2-3	"	573	2.66	Osteosarcoma	Renal adenocarcinoma
IP8-2-2-4	"	610	2.79	Osteofibrosarcoma	
IP8-2-2-5	"	632	2.86	Lymphoma	
IP8-2-2-6	"	670	2.98	Lymphoma	
IP8-2-2-7	"	684	3.03	Mam.fibroadenocarcinoma	
IP8-2-2-8	"	744	3.21		
IP8-2-2-9	"	795	3.36	Lymphoma	
IP8-2-3-1	"	237	1.27	Leukemic lymphoma	
IP8-2-3-2	"	442	2.17	Myeloid leukemia	
IP8-2-3-3	"	471	2.28		
IP8-2-3-4	"	487	2.34	Osteosarcoma	
IP8-2-3-5	"	507	2.42		
IP8-2-3-6	"	509	2.43		local.osteofibrosarcoma
IP8-2-3-7	"	519	2.47		
IP8-2-3-8	"	525	2.49	nodular hepatocellular Ca	
IP8-2-3-9	"	623	2.83		
IP8-2-3-10	"	625	2.84	Osteosarcoma	
IP8-2-3-11	"	646	2.91	Osteofibrosarcoma	
IP8-2-3-12	"	677	3.01	Hepatocellular carcinoma	

### **Group IP8 (BC3)**

[Age at injections: 105 days/Injected doses: 500 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP8-3-1-1	500	414	2.06	Lymphoma	Osteoma
IP8-3-1-2	"	454	2.22		
IP8-3-1-3	"	477	2.31	Osteosarcoma	local.osteosarcoma
IP8-3-1-4	"	487	2.34	Osteosarcoma	
IP8-3-1-5	"	507	2.42	Lymphoma	local.osteosarcoma
IP8-3-1-6	"	523	2.48		
IP8-3-1-7	"	604	2.77		local.osteosarcoma
IP8-3-1-8	"	641	2.89	Giant cell osteosarcoma	
IP8-3-1-9	"	682	3.02		local.osteosarcoma
IP8-3-1-10	"	831	3.46	Osteosarcoma	
IP8-3-2-1	"	465	2.26	Leukemic lymphoma	local.osteosarcoma
IP8-3-2-2	"	519	2.47	Leukemic lymphoma	
IP8-3-2-3	"	527	2.49	Osteosarcoma	local.osteosarcoma
IP8-3-2-4	"	535	2.52		
IP8-3-2-5	"	540	2.54		local.osteosarcoma
IP8-3-2-6	"	566	2.63	SC adenocarcinoma	
IP8-3-2-7	"	586	2.70	Pulm.adenocarcinoma	local.osteosarcoma
IP8-3-2-8	"	647	2.91		
IP8-3-2-9	"	679	3.01		local.osteosarcoma
IP8-3-2-10	"	1016	3.93		
IP8-3-3-1	"	420	2.08		local.osteosarcoma
IP8-3-3-2	"	481	2.32		
IP8-3-3-3	"	500	2.39		local.osteosarcoma
IP8-3-3-4	"	505	2.41	Osteosarcoma	
IP8-3-3-5	"	521	2.47	Osteosarcoma	local.osteosarcoma
IP8-3-3-6	"	523	2.48	Leukemic lymphoma	
IP8-3-3-7	"	530	2.51	Osteosarcoma	Pulm.adenocarcinoma
IP8-3-3-8	"	544	2.56		
IP8-3-3-9	"	579	2.68	Osteosarcoma	local.osteoma
IP8-3-3-10	"	580	2.68	Ov.sarcoma	
IP8-3-3-11	"	590	2.72	Osteosarcoma	local.osteoma
IP8-3-3-12	"	608	2.78		
IP8-3-3-13	"	647	2.91		

**Group IP9 (C3H)**

[Age at injections: 122 days/Injected doses: 1000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP9-1-1-1	1000	333	3.43		
IP9-1-1-2	"	347	3.55		
IP9-1-1-3	"	408	4.07	Osteosarcoma	
IP9-1-1-4	"	467	4.54	Giant cell Osteosarcoma	
IP9-1-1-5	"	479	4.63		
IP9-1-1-6	"	485	4.68		
IP9-1-1-7	"	499	4.78		
IP9-1-1-8	"	521	4.95		
IP9-1-1-9	"	529	5.00	Osteosarcoma	
IP9-1-1-10	"	575	5.33	Osteosarcoma	
IP9-1-2-1	"	375	3.79		local.osteosarcoma
IP9-1-2-2	"	402	4.02		
IP9-1-2-3	"	413	4.11		
IP9-1-2-4	"	434	4.28	Osteosarcoma	
IP9-1-2-5	"	472	4.58	Osteosarcoma	
IP9-1-2-6	"	480	4.64	Osteosarcoma	
IP9-1-2-7	"	483	4.66		
IP9-1-2-8	"	495	4.75		
IP9-1-2-9	"	511	4.87		
IP9-1-2-10	"	512	4.88		
IP9-1-2-11	"	528	5.00		
IP9-1-3-1	"	259	2.76	Osteosarcoma	
IP9-1-3-2	"	405	4.04		
IP9-1-3-3	"	406	4.05		local.osteoma
IP9-1-3-4	"	425	4.21		local.osteosarcoma
IP9-1-3-5	"	440	4.33		
IP9-1-3-6	"	444	4.36		local.osteosarcoma
IP9-1-3-7	"	445	4.37	Osteosarcoma	
IP9-1-3-8	"	448	4.39		local.osteosarcoma
IP9-1-3-9	"	618	5.63		

**Group IP9 (C57)**

[Age at injections: 142 days/Injected doses: 1000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP9-2-1-1	1000	252	2.69		
IP9-2-1-2	"	293	3.07		Osteosarcoma
IP9-2-1-3	"	339	3.48	Osteosarcoma	
IP9-2-1-4	"	369	3.74	Stomach lymphoma	
IP9-2-1-5	"	378	3.82		
IP9-2-1-6	"	385	3.88		local.osteosarcoma
IP9-2-1-7	"	405	4.04	Osteosarcoma	
IP9-2-1-8	"	408	4.07		
IP9-2-1-9	"	440	4.33		
IP9-2-1-10	"	442	4.34	Osteosarcoma	
IP9-2-2-1	"	300	3.14		
IP9-2-2-2	"	304	3.17		
IP9-2-2-3	"	353	3.61		
IP9-2-2-4	"	363	3.69	Osteosarcoma	
IP9-2-2-5	"	369	3.74		
IP9-2-2-6	"	371	3.76	Lymphoma	
IP9-2-2-7	"	373	3.78		
IP9-2-2-8	"	454	4.44		local.osteosarcoma
IP9-2-2-9	"	521	4.95	Osteosarcoma	
IP9-2-2-10	"	597	5.49		
IP9-2-3-1	"	348	3.56		local.osteosarcoma
IP9-2-3-2	"	355	3.62	Osteosarcoma	
IP9-2-3-3	"	386	3.89		
IP9-2-3-4	"	411	4.09	Osteosarcoma	
IP9-2-3-5	"	413	4.11		local.osteosarcoma
IP9-2-3-6	"	442	4.34		
IP9-2-3-7	"	466	4.53	Giant cell osteosarcoma	
IP9-2-3-8	"	471	4.57	Osteosarcoma	
IP9-2-3-9	"	500	4.79		
IP9-2-3-10	"	551	5.16	Osteosarcoma	
IP9-2-3-11	"	567	5.28	Lymphoma	
IP9-2-3-12	"	573	5.32	Osteosarcoma	

### Group IP9 (BC3)

[Age at injections: 122 days/Injected doses: 1000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP9-3-1-1	1000	331	3.41		
IP9-3-1-2	"	380	3.84		local.osteosarcoma
IP9-3-1-3	"	383	3.86		
IP9-3-1-4	"	396	3.97		
IP9-3-1-5	"	397	3.98	Leukemic lymphoma	
IP9-3-1-6	"	405	4.04	Osteosarcoma	
IP9-3-1-7	"	415	4.13	Osteosarcoma	
IP9-3-1-8	"	438	4.31	Osteosarcoma	
IP9-3-1-9	"	466	4.53		local.osteosarcoma
IP9-3-1-10	"	528	5.00	Hepatocellular carcinoma	
IP9-3-1-11	"	567	5.28		
IP9-3-2-1	"	376	3.80		
IP9-3-2-2	"	377	3.81		
IP9-3-2-3	"	401	4.01	Leukemic lymphoma	
IP9-3-2-4	"	416	4.13		
IP9-3-2-5	"	432	4.26		
IP9-3-2-6	"	440	4.33	Osteosarcoma	
IP9-3-2-7	"	450	4.41		
IP9-3-2-8	"	499	4.78		local.osteosarcoma
IP9-3-2-9	"	505	4.83	Osteosarcoma	
IP9-3-2-10	"	546	5.13		
IP9-3-2-11	"	574	5.33	Myeloid leukemia	local.osteosarcoma
IP9-3-3-1	"	398	3.99		
IP9-3-3-2	"	399	3.99		Osteoma
IP9-3-3-3	"	401	4.01		
IP9-3-3-4	"	424	4.20		
IP9-3-3-5	"	446	4.37		
IP9-3-3-6	"	451	4.41		
IP9-3-3-7	"	470	4.56		local.osteosarcoma
IP9-3-3-8	"	481	4.65		
IP9-3-3-9	"	532	5.03	Osteosarcoma	
IP9-3-3-10	"	537	5.06	Osteosarcoma	
IP9-3-3-11	"	571	5.31		

### **Group IP10 (C3H)**

[Age at injections: 98 days/Injected doses: 5000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP10-1-1	5000	230	12.4	Lymphoma	local.osteosarcoma
IP10-1-2	"	276	14.6	Lymphoma	
IP10-1-3	"	281	14.8		
IP10-1-4	"	308	16.0	Osteosarcoma	
IP10-1-5	"	325	16.8	Osteosarcoma	
IP10-1-6	"	340	17.5	Osteosarcoma	
IP10-1-7	"	364	18.5	Osteosarcoma	
IP10-1-8	"	366	18.6	Osteosarcoma	
IP10-1-9	"	367	18.6	local.osteosarcoma	
IP10-1-10	"	"	"	Osteosarcoma	
IP10-1-11	"	"	"	Osteosarcoma	
IP10-1-12	"	"	"		

### **Group IP10 (C3H)**

[Age at injections: 98 days/Injected doses: 5000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP10-2-1	5000	195	10.7	Leukemic lymphoma	local.osteosarcoma
IP10-2-2	"	245	13.1	Leukemic lymphoma	
IP10-2-3	"	292	15.3		
IP10-2-4	"	294	15.4		
IP10-2-5	"	298	15.6		
IP10-2-6	"	330	17.0	Giant cell osteosarcoma	
IP10-2-7	"	354	18.1	Lymphoma	
IP10-2-8	"	356	18.2		
IP10-2-9	"	356	18.2	Osteofibrosarcoma	
IP10-2-10	"	365	18.5	Osteosarcoma	
IP10-2-11	"	397	19.9		

### **Group IP10 (C3H)**

[Age at injections: 98 days/Injected doses: 5000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP10-3-1	5000	160	8.92	Leukemic lymphoma	
IP10-3-2	"	179	9.89		
IP10-3-3	"	"	"		
IP10-3-4	"	"	"		
IP10-3-5	"	"	"		
IP10-3-6	"	"	"		
IP10-3-7	"	"	"		
IP10-3-8	"	199	10.9	Lymphoma	
IP10-3-9	"	266	14.1	Osteosarcoma	
IP10-3-10	"	276	14.6		
IP10-3-11	"	"	"		
IP10-3-12	"	"	"	Osteosarcoma	



### **Group IP11 (C3H)**

[Age at injections: 93 days/Injected doses: 5000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP11-1-2-1	5000	237	12.7		
IP11-1-2-2	"	"	"		
IP11-1-2-3	"	"	"		
IP11-1-2-4	"	279	14.7		
IP11-1-2-5	"	297	15.5	Osteosarcoma	
IP11-1-2-6	"	298	15.6	Osteosarcoma	
IP11-1-2-7	"	333	17.2	Osteosarcoma	
IP11-1-2-8	"	"	"		
IP11-1-2-9	"	"	"		
IP11-1-2-10	"	"	"		
IP11-1-3-1	"	237	12.7		
IP11-1-3-2	"	252	13.5		
IP11-1-3-3	"	276	14.6		
IP11-1-3-4	"	290	15.2		
IP11-1-3-5	"	293	15.4		
IP11-1-3-6	"	335	17.2		local.osteoma
IP11-1-3-7	"	348	17.8	Osteosarcoma	
IP11-1-3-8	"	362	18.4	Osteosarcoma	
IP11-1-3-9	"	362	18.4		
IP11-1-3-10	"	429	21.2	Osteosarcoma	

### **Group IP11 (C57)**

[Age at injections: 107 days/Injected doses: 5000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP11-2-2-1	5000	238	12.8		
IP11-2-2-2	"	"	"		
IP11-2-2-3	"	"	"		
IP11-2-2-4	"	283	14.9		
IP11-2-2-5	"	307	16.0		local.osteosarcoma
IP11-2-2-6	"	334	17.2		
IP11-2-2-7	"	"	"		
IP11-2-2-8	"	"	"		
IP11-2-2-9	"	384	19.3		local.osteofibrosarcoma
IP11-2-2-10	"	465	22.6		local.osteosarcoma
IP11-2-3-1	"	300	15.7		
IP11-2-3-2	"	323	16.7	Osteosarcoma	
IP11-2-3-3	"	357	18.2	Osteosarcoma	
IP11-2-3-4	"	363	18.5	Osteosarcoma	
IP11-2-3-5	"	373	18.9	Osteosarcoma	
IP11-2-3-6	"	378	19.1		local.osteoma
IP11-2-3-7	"	386	19.4	Osteosarcoma	
IP11-2-3-8	"	390	19.4	Osteosarcoma	
IP11-2-3-9	"	434	21.4	Osteosarcoma	
IP11-2-3-10	"	691	30.5		

### **Group IP11 (BC3)**

[Age at injections: 93 days/Injected doses: 5000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP11-3-2-1	5000	215	11.7	Leukemic lymphoma	local.osteosarcoma
IP11-3-2-2	"	239	12.8		
IP11-3-2-3	"	"	"		
IP11-3-2-4	"	"	"		
IP11-3-2-5	"	313	16.3		
IP11-3-2-6	"	330	17.0		
IP11-3-2-7	"	335	17.2		
IP11-3-2-8	"	"	"		
IP11-3-2-9	"	"	"		
IP11-3-2-10	"	"	"		
IP11-3-3-1	"	280	14.8		local.osteosarcoma
IP11-3-3-2	"	304	15.9	Osteosarcoma	
IP11-3-3-3	"	319	16.5	Osteosarcoma	
IP11-3-3-4	"	320	16.6	Osteosarcoma	
IP11-3-3-5	"	329	17.0	SC fibrosarcoma	
IP11-3-3-6	"	338	17.4		
IP11-3-3-7	"	353	18.0	Osteosarcoma	
IP11-3-3-8	"	354	18.1	Osteosarcoma	
IP11-3-3-9	"	366	18.6		
IP11-3-3-10	"	397	19.9	Osteosarcoma	

### **Group IP12 (C3H)**

[Age at injections: 115 days/Injected doses: 10000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP12-3-1	10000	217	23.6		Osteoma
IP12-1-1	"	220	23.8	Osteosarcoma	
IP12-2-1	"	222	24.0	Lymphoma	
IP12-1-2	"	225	27.8	Lymphoma	
IP12-2-2	"	261	28.5		
IP12-2-3	"	269	28.6		
IP12-2-4	"	270	28.6	Osteosarcoma	
IP12-3-2	"	270	28.6		
IP12-3-3	"	274	29.0		
IP12-3-4	"	283	29.8		
IP12-2-5	"	290	30.5	Lymphoma	
IP12-2-6	"	298	31.2		
IP12-3-5	"	305	31.8		
IP12-3-6	"	321	33.3	Osteosarcoma	
IP12-2-7	"	321	33.3	Osteosarcoma	
IP12-2-8	"	333	34.3		
IP12-3-7	"	343	35.2		
IP12-3-8	"	375	37.9		
IP12-3-9	"	407	40.6	Osteosarcoma	
IP12-2-9	"	423	41.9		
IP12-3-10	"	423	41.9	Osteosarcoma	
IP12-3-11	"	443	43.5	Osteosarcoma	
IP12-2-10	"	731	64.5		

**Group IP13 (C57)**

[Age at injections: 115 days/Injected doses: 10000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP13-1-1	10000	294	30.8	Thymic lymphoma	
IP13-2-1	"	328	33.9		
IP13-1-2	"	336	34.6	Lymphoma	
IP13-3-1	"	340	34.9		
IP13-3-2	"	354	36.1		
IP13-3-3	"	368	37.3		
IP13-3-4	"	372	37.7		
IP13-2-2	"	379	38.3	Osteosarcoma	
IP13-2-3	"	381	38.5	Osteosarcoma	
IP13-1-3	"	406	40.5	SC sarcoma	
IP13-3-5	"	412	41.0		
IP13-2-4	"	416	41.3	Lymphoma	
IP13-3-6	"	433	42.7		
IP13-3-7	"	444	43.6		
IP13-1-4	"	446	43.7	Osteosarcoma	
IP13-1-5	"	448	43.9		
IP13-2-5	"	476	46.1		
IP13-2-6	"	476	46.1		
IP13-2-7	"	481	46.5		
IP13-2-8	"	487	46.9		
IP13-2-9	"	487	46.9		
IP13-2-10	"	488	47.0		
IP13-3-8	"	507	48.4		
IP13-3-9	"	509	48.6		
IP13-3-10	"	578	53.5	Osteosarcoma	
IP13-3-11	"	724	63.1	Lymphoma	

### Group IP14 (BC3)

[Age at injections: 122 days/Injected doses: 10000 Bq]

Animal ID	IP Dose (Bq)	Survival (day)	Sk.Dose (Gy)	Histopathology	
				Fatal Tumors	Incidental Tumors
IP14-3-1	10000	180	19.9		
IP14-1-1	"	202	22.1	Lymphoma	
IP14-1-2	"	291	30.6	Lymphoma	
IP14-2-1	"	314	32.6	SC squamous cell carcinoma	
IP14-3-2	"	340	34.9		
IP14-3-3	"	349	35.7		
IP14-3-4	"	352	36.0		
IP14-3-5	"	369	37.4		
IP14-3-6	"	371	37.6		
IP14-1-3	"	375	37.9	Osteosarcoma	
IP14-1-4	"	384	38.7		
IP14-2-2	"	386	38.9	Leukemic lymphoma	
IP14-1-5	"	403	40.3	Osteosarcoma	
IP14-3-7	"	414	41.2		
IP14-3-8	"	419	41.6	Osteosarcoma	
IP14-2-3	"	425	42.1	Osteosarcoma	
IP14-1-6	"	433	42.7		
IP14-2-4	"	434	42.8		local.osteosarcoma
IP14-2-5	"	444	43.6		
IP14-1-7	"	446	43.7		
IP14-1-8	"	453	44.3		Osteoma
IP14-2-6	"	461	44.9		
(IP14-1-9)	"	(471)	(45.7)	[?]	
IP14-2-7	"	473	45.8		Osteoma
IP14-2-8	"	480	46.4		
IP14-3-9	"	516	49.1		SC fibrosarcoma
IP14-1-10	"	537	50.6		Osteoma
IP14-3-10	"	538	50.7		
IP14-2-9	"	539	50.8	Osteosarcoma	
IP14-3-11	"	558	52.1	Osteosarcoma	
IP14-1-11	"	571	53.1		microscopic osteoma
IP14-2-10	"	573	53.2		

### Non-Neoplastic Lesions from the Groups of $^{239}\text{Pu}$ -Injected and Control Animals

The non-neoplastic lesions from the experimental groups of  $^{239}\text{Pu}$ -injected and control animals (Groups IP1 to IP5 of C3H mice and IP7 to IP14 of three strains of mice) are summarized only for individual cases that were described in the histopathological findings. The tables as below contain the information on the injected dose, survival period, and histopathological diagnosis of non-neoplastic lesions and neoplasms in each case.

**Groups IP1-5, IP7-11 & IP12 (C3H)**

Animal ID	IP Dose (Bq)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
IP8-1-Ct1-1	0	387	Liv fatty degeneration	HCC HCC     Pulm. adenoma
IP7-1-Ct1-1	0	672	Liv necrosis	
IP7-1-Ct1-2	0	683	Kid interstitial lym.inflt	
IP7-1-Ct1-6	0	853	Liv fatty degeneration	
IP7-1-Ct1-8	0	895	Kid glomerular mineralization	
IP9-1-Ct2-3	0	705	Liv fatty degeneration	
IP12-Ct-2	0	487	Kid interst.fibrosis, glomerul.hyaliniz. & casts	
IP12-Ct-7	0	666	Liv fibrous nodule	
IP12-Ct-9	0	805	Liv PMNs & MNs inflt	
IP4-2-2	10	528	Pulm.septal fibrosis	SC fibrosarcoma   SC Bas.Ca/Pulm.AC  HCC
IP5-2-2	10	565	Liv fatty deg. & fibrosis	
IP4-1-5	10	661	Liv fatty degeneration	
IP4-2-5	10	670	Liv fatty deg./Ut.endometritis	
IP4-2-7	10	804	Ut.endometritis	
IP5-3-3	10	773	Ut.endometritis	
IP5-3-6	10	787	Liv cirrhosis & fatty deg.	
IP5-3-7	10	790	Pneumonitis with fibrosis	
IP5-2-7	10	811	Kid int.lym.inflt	
IP5-3-10	10	890	Kid int.lym.inflt	
IP5-5-2	100	284	Pulm.mineralization	Osteoma Ov.tumor OS Ov.tumor
IP4-5-1	100	732	Liv necrosis & lym.inflt	
IP4-3-5	100	747	Liv deg./Sp fibrosis	
IP4-5-4	100	777	Liv degeneration	
IP5-5-6	100	752	Liv fatty degeneration	
IP5-5-8	100	801	Pulm.cyst.emphysema/Kid urinary casts	
IP4-4-10	100	869	Liv fatty droplets	
IP5-4-9	100	832	Glomerulonephritis	
IP4-3-10	100	906	SalGl fibrosis	
IP5-5-9	100	851	Liv lym. & PC inflt	Pulm.AC Pulm.AD HCC OS Limb fibrosarcoma SCFS/HCC HCC  OS  SC fibrosarcoma
IP7-1-1-1	100	720	Kid glomerul. hyaliniz./Liv fatty deg. & necro.	
IP7-1-2-3	100	741	Kid interstitial nephritis	
IP7-1-1-3	100	754	Liv pericholangiolar lym.inflt	
IP7-1-2-4	100	768	Kid interst.lym.inflt	
IP7-1-3-4	100	775	Liv centrilobular focal necrosis	
IP7-1-2-5	100	777	Liv focal necrosis	
IP7-1-2-7	100	781	Liv fatty degeneration	
IP7-1-1-4	100	791	Liv fatty droplets	
IP7-1-3-7	100	866	Liv interst.perivas.lym.inflt/Kid int.lym.inflt	
IP2-4-1	500	294	Liv fatty droplets	micro.OS micro.OS  OS meta. HCC Lym.Leukemia Lymphoma OS  OS micro.OS
IP2-4-2	500	310	Liv fatty droplets	
IP3-4-1	500	311	Liv embolism	
IP1-4-2	500	470	Dermal alopecia	
IP1-4-4	500	543	Liv centrilob.vacuolar degeneration	
IP2-4-3	500	494	SalGl lym.inflt/anemia	
IP1-4-5	500	559	Liv micro.necrosis	
IP2-4-4	500	538	Kid tubular hyalinization & eosin.granules	
IP1-4-7	500	622	Pulm granuloma	
IP3-4-5	500	495	Pulm.granuloma	OS micro.OS
IP1-4-8	500	638	Liv micro.granuloma/Kid int.PMN/BM fibr.	
IP3-4-7	500	532	Liv fatty & ves. deg./Kid glomer. atrophy	
IP2-4-6	500	591	Int.nephritis & urinary casts	
IP2-4-7	500	602	Kid hydrotubule/Pan.int.lym.inflt	
IP3-4-10	500	680	Liv granuloma	
IP3-4-11	500	688	Liv granuloma	

**Groups IP1-5, IP7-11 & IP12 (C3H; Cont'd)**

Animal ID	IP Dose (Bq)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
IP2-3-1	1000	322	Fatty Liver/Glomerular atrophy	micro.OS
IP2-3-2	1000	322	Fatty Liver/Glomerular atrophy	
IP3-3-1	1000	332	Interst.pancreatitis	
IP3-3-3	1000	387	Pyelonephritis	micro.OS
IP1-3-9	1000	556	Liv perichollangiol. lym.inflt/interst.nephritis	
IP3-3-5	1000	447	Liv vacuol.vesicul.deg. & peicholla.fibr./Pan. L'islets atrophy/SalGl interst.lym.inflt.	
IP3-3-6	1000	452	Pan.int.fibrosis & lym.inflt.	OS
IP2-2-1	5000	300	Liv fatty droplets	Lym.Leukemia micro. OS micro.OS
IP3-2-2	5000	297	Liv dissem. fatty degeneration	
IP3-2-3	5000	311	Liv perilob.fatty degeneration	
IP3-2-6	5000	383	Fatty Liver	Lym.Leukemia
IP2-2-9	5000	620	Liv degeneration/BM fibrosis	
IP10-2-1	5000	195	Liv fatty degeneration	
IP10-3-7	5000	199	BM fibrosis	Lym.Leukemia Leukemia ? Sp.lymphoma OS  micro.OS
IP11-1-3-9	5000	362	Kid interst.mononuclear inflt	
IP3-1-1	10000	233	Liv fatty droplets	
IP3-1-2	10000	254	Liv fatty droplets	
IP2-1-2	10000	330	Liv fatty droplets	
IP1-1-9	10000	438	Liv micro.necrosis/Kid urinary casts	
IP2-1-7	10000	398	Liv fatty droplets/fibrous adhesive abd.organs	
IP3-1-8	10000	430	Myocardial fibrosis	
IP3-1-10	10000	452	Liv degeneration	
IP12-2-2	10000	261	Fatty Liver	
IP12-2-3	10000	269	Liv fatty degeneration & focal necrosis	
IP12-2-6	10000	298	Liv fatty degeneration	
IP12-3-5	10000	305	Liv fatty deg./Kid hydronephrosis & fibrosis	
IP12-3-7	10000	343	Kid hydronephrosis	
IP12-3-8	10000	375	Kid hydronephrosis	
IP12-2-9	10000	423	Kid hydronephrosis	
IP12-2-10	10000	731	Liv fatty degeneration	

### Groups IP7-11 & IP13 (C57)

Animal ID	IP Dose (Bq)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
IP7-2-Ct2-3	0	625	Ht coronary fibrous thickening	Myeloid Leukemia  Histiocytic Lym.        HCC  Lymphoma  HCC
IP7-2-Ct2-4	0	734	Liv fatty liver	
IP9-2-Ct1-2	0	391	Liv perivascular lym.inflt	
IP9-2-Ct1-5	0	423	Liv sin.perivas.lym.inflt/Lg peribron.lym.prol.	
IP7-2-Ct1-6	0	803	Liv fatty droplets & int.perivas.lym.inflt	
IP9-2-Ct2-5	0	449	Kid glomerular hyalinization	
IP8-2-Ct2-2	0	641	Liv sinusoid.mononuclear & perivas.lym.inflt	
IP9-2-Ct1-7	0	489	Liv perivascu.lym.inflt/Lg peribronch.lym.gr.	
IP8-2-Ct1-7	0	678	Liv fatty degeneration	
IP8-2-Ct2-5	0	748	Lg alveolar eosinophilic deposits	
IP8-2-Ct2-6	0	793	Lg alveolar eosinophilic deposits	
IP8-2-Ct2-7	0	795	Lg alveolar eosinophilic deposits	
IP8-2-Ct2-9	0	829	Lg alveolar eosinophilic deposits	
IP8-2-Ct2-10	0	833	Liv sinusoidal & interstitial lym.inflt	
IP8-2-Ct1-10	0	885	Liv fatty degeneration	
IP13-Ct-4	0	648	Liv lym.inflt/Lg perivas. lym.inflt	
IP13-Ct-5	0	649	Kid pelvic interst.lym.inflt	
IP13-Ct-6	0	652	Lg alveolar eosinophilic deposits	
IP13-Ct-7	0	727	Kid urinary casts	
IP13-Ct-8	0	799	Kid fibrous scar/Liv necrosis & fatty deg.	
IP7-2-2-3	100	655	Kid interst.perivascu.lym.inflt	Osteoma          HCC
IP7-2-3-4	100	669	Liv focal necrosis	
IP7-2-1-3	100	681	Lg & Kid interst.lym.inflt	
IP7-2-2-4	100	703	Liv necrotizing hepatitis	
IP7-2-3-6	100	717	Liv promyel.inflt/Lg alveol. eosinophil. sub.	
IP7-2-1-5	100	724	Liv fatty degeneration	
IP7-2-1-7	100	764	Liv cholangiolar proliferation	
IP7-2-3-10	100	782	Liv interst.lym.inflt & fibrosis	
IP7-2-1-8	100	807	Liv sinusoid & perivascular mononuclear inflt	
IP7-2-2-7	100	822	Liv micronecrosis & sin.mononuclear inflt	
IP7-2-1-10	100	917	Lg hemorrhage, edema & alveolar eosino.dep.	
IP8-2-2-1	500	364	Kid glomerular hyalinization	Pulm.AC
IP8-2-3-4	500	487	Kid pelvic interst.lym.inflt	OS
IP8-2-3-6	500	509	Liv necrotizing hepatitis	OS
IP8-2-3-8	500	525	Liv fatty degeneration	HCC
IP8-2-1-3	500	549	SalGl interstitial lym.inflt	Abd. sarcoma
IP8-2-2-8	500	744	Kid & Lg perivascular lym.inflt	
IP9-2-2-3	1000	353	Liv fatty degeneration	OS OS
IP9-2-3-2	1000	355	Kid interstitial nephritis	
IP9-2-3-4	1000	411	Liv perivasc.lym.inflt/Kid glomerular hyaliniz.	
IP11-2-3-5	5000	373	Kid cyst	OS
IP13-1-6	10000		Kid interst.PMNs & lym.inflt	Thymic Lymphoma OS  OS
IP13-1-1	10000	294	Liv fatty degeneration	
IP13-2-3	10000	381	Liv fatty degeneration	
IP13-3-8	10000	507	Kid hydronephrosis	
IP13-3-10	10000	578	Kid hydronephrosis	

### Groups IP7-11 & IP14 (BC3)

Animal ID	IP Dose (Bq)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
IP7-3-Ct2-1	0	671	Ut endometritis/chyloperitoneum	Lymphoma
IP7-3-Ct1-7	0	815	Liv fatty deg./Lg perivascular lym.inflt	
IP9-3-Ct1-2	0	453	Fatty Liver	
IP8-3-Ct1-2	0	665	Liv fatty degeneration	
IP7-3-Ct1-9	0	897	Kid interstitial lym.inflt	
IP8-3-Ct2-7	0	896	Liv centrilobular necrosis & fatty deg.	
IP8-3-Ct1-9	0	994	Lg alveolar eosinophilic deposits	
IP9-3-Ct1-8	0	859	Kid glomerular hyalinization	
IP14-Ct-1	0	569	Liv focal degeneration & necrosis	
IP14-Ct-2	0	740	Liv centrilobular necrosis	Myeloid Leukemia
IP14-Ct-9	0	838	Kid pelvic lym.inflt	
IP7-3-1-1	100	614	Kid & Lg perivascular lymphoid inflt	SC fibrosarcoma SC fibrosarcoma OS Mam.AC
IP7-3-3-3	100	639	Liv perivascular lym.inflt	
IP7-3-1-4	100	649	Liv sinusoid PMNs & interst.lym.inflt	
IP7-3-3-4	100	699	Liv sinusoid PMNs/Kid & Lg int.fibrosis	
IP7-3-3-5	100	704	Liv int.lym.inflt/Kid subcapsular fibrosis	
IP7-3-3-8	100	725	Liv focal necrosis	
IP7-3-3-11	100	822	Fatty Liver	
IP7-3-1-8	100	856	Liv interst.perivascular mononuclear inflt	
IP8-3-3-1	500	420	Lg bronchial papillary gr/BM fat dep	OS Pulm.AC/OS OS
IP8-3-3-8	500	544	Lg perivascular lym.inflt	
IP8-3-2-7	500	586	Kid glomerular swelling & hyalinization	
IP8-3-1-8	500	641	Liv fatty droplets & Pitt cells	
IP8-3-1-9	500	682	Kid pelvic interstitial mononuclear inflt	OS OS HCC/OvT Myel.Leuk. /OS
IP9-3-1-1	1000	331	Liv fatty deg./Kid glomerulonephritis	
IP9-3-2-2	1000	377	Kid pelvic interst.lym.inflt	
IP9-3-1-2	1000	380	Kid pelvic interst.lym.inflt	
IP9-3-1-4	1000	396	Kid interst. & Sp subcapsular amyloidosis	
IP9-3-3-1	1000	398	Kid pelvic interst.lym.inflt	
IP9-3-2-4	1000	416	Liv interst.perivasc.mononuclear inflt	
IP9-3-3-7	1000	470	Kid pelvic interst.perivascular lym.inflt	
IP9-3-1-10	1000	528	Liv fatty degeneration	
IP9-3-2-11	1000	574	Liv focal necrosis/Kid interst.lym.inflt	
IP14-3-2	10000	340	Liv fatty degeneration	micro. OS SC fibrosarcoma
IP14-3-3	10000	349	Liv fatty & vesicular degeneration	
IP14-2-4	10000	434	Kid hydronephrosis	
IP14-2-5	10000	444	Sp Gamna-Gandy body	
IP14-2-8	10000	480	Liv lym.inflt & fibrosis	
IP14-3-9	10000	516	Kid hydronephrosis	
IP14-3-10	10000	538	Kid hydronephrosis	
IP14-3-11	10000	558	Liv lym.inflt/Kid hydronephrosis	
IP14-2-10	10000	573	Sp Gandy-Gamna body	



### 3.2.2 Experimental Groups for Injections of MNU

#### Groups of MNU-Injected Animals

The experimental groups of MNU-injected animals as listed below include the Groups MNU-1 to MNU-6 of three strains of mice, and the information on the experimental regimens including the age of animals at injections and total injected doses is attached to the head of the table for each group, respectively.

#### Group MNU-1 (C3H)

[Age at the cessation of injections: 91 days/Injected doses: 5-6 mg/animal]

Animal ID	Survival/Post-IP (day)	Histopathology	
		Lymphoid Neoplasms	Other Tumors
MNU-1-1-1	141/50		
MNU-1-3-1	156/65		
MNU-1-3-3	160/69		
MNU-1-3-4	166/75	Thymic lymphoma	
MNU-1-3-5	171/80	Thymic lymphoma	
MNU-1-3-6	176/85	Thymic lymphoma	
MNU-1-2-1	178/87	Thymic lymphoma	
MNU-1-3-7	178/87	Thymic lymphoma	
MNU-1-2-2	181/90		Stomach squamous cell carcinoma
MNU-1-3-8	186/95	Thymic lymphoma	
MNU-1-2-3	196/106	Thymic lymphoma	
MNU-1-1-2	200/110	Thymic lymphoma	
MNU-1-3-9	205/115	Thymic lymphoma	
MNU-1-1-3	205/115	Lymphoid leukemia	Stomach squamous cell carcinoma
MNU-1-3-10	209/119	Thymic lymphoma	
MNU-1-3-11	210/120	Thymic lymphoma	
MNU-1-1-4	219/129		
MNU-1-2-4	227/137	Thymic lymphoma	
MNU-1-1-5	233/142	Thymic lymphoma	Stomach squamous cell carcinoma
MNU-1-1-6	256/165		
MNU-1-2-5	266/175		
MNU-1-2-6	284/193		Ur.BI.fibrosarcoma
MNU-1-1-7	295/204		
MNU-1-2-7	317/226		Stomach squamous cell carcinoma
MNU-1-1-8	333/242		Stomach squamous cell carcinoma
MNU-1-2-8	351/260		Uterus carcinoma
MNU-1-1-9	355/264		Ov. granulosa cell tumor
MNU-1-2-9	374/283		Ov. adenocarcinoma
MNU-1-1-10	390/299		Stomach SCC/Lung adenoma

**Group MNU-2 (C57)**

[Age at the cessation of injections: 89 days/Injected doses: 5-6 mg/animal]

Animal ID	Survival/Post-IP (day)	Histopathology	
		Lymphoid Neoplasms	Other Tumors
MNU-2-2-1	132/43	Thymic lymphoma	
MNU-2-3-1	134/45	Thymic lymphoma	
MNU-2-1-1	141/52		
MNU-2-1-2	141/52		
MNU-2-1-3	141/52		
MNU-2-3-2	143/54	Thymic lymphoma	
MNU-2-1-4	143/54	Thymic lymphoma	
MNU-2-3-3	144/55	Thymic lymphoma	
MNU-2-1-5	146/57		
MNU-2-3-4	146/57		
MNU-2-2-2	152/63		
MNU-2-3-5	153/64	Thymic lymphoma	
MNU-2-1-6	154/65		
MNU-2-2-3	155/66		
MNU-2-3-6	159/70		
MNU-2-3-7	159/70	Thymic lymphoma	
MNU-2-2-4	165/76		
MNU-2-3-8	166/77	Thymic lymphoma	
MNU-2-2-5	167/78		
MNU-2-3-9	170/81	Thymic lymphoma	
MNU-2-1-7	170/81	Lymphoma	
MNU-2-3-10	173/84		
MNU-2-3-11	173/84		

**Group MNU-3 (BC3)**

[Age at the cessation of injections: 90 days/Injected doses: 5-6 mg/animal]

Animal ID	Survival/Post-IP (day)	Histopathology	
		Lymphoid Neoplasms	Other Tumors
MNU-3-1-1	121/31	Thymic lymphoma	Stomach squamous cell carcinoma
MNU-3-1-2	127/37		
MNU-3-3-1	129/39	Thymic lymphoma	
MNU-3-3-2	138/48	Thymic lymphoma	
MNU-3-1-3	141/51	Thymic lymphoma	
MNU-3-2-1	143/53		
MNU-3-1-4	145/55	Thymic lymphoma	
MNU-3-2-2	148/58		
MNU-3-3-3	151/61	Thymic lymphoma	
MNU-3-2-3	151/61	Thymic lymphoma	
MNU-3-2-4	155/65	Thymic lymphoma	
MNU-3-3-4	157/67	Thymic lymphoma	
MNU-3-1-5	158/68	Thymic lymphoma	
MNU-3-2-5	159/69	Thymic lymphoma	
MNU-3-1-6	160/70	Thymic lymphoma	
MNU-3-1-7	166/76	Thymic lymphoma	
MNU-3-3-5	169/79	Lymphoma	
MNU-3-2-6	172/82	Thymic lymphoma	
MNU-3-3-6	172/82	Thymic lymphoma	
MNU-3-1-8	175/85	Thymic lymphoma	
MNU-3-3-7	180/90	Thymic lymphoma	
MNU-3-1-9	183/93	Lymphoma	
MNU-3-3-8	184/94		
MNU-3-2-7	185/95		
MNU-3-3-9	186/96	Thymic lymphoma	
MNU-3-1-10	188/98	Thymic lymphoma	
MNU-3-2-8	192/102	Lymphoma	
MNU-3-2-9	194/104	Thymic lymphoma	
MNU-3-3-10	194/104	Thymic lymphoma	
MNU-3-1-11	198/108	Thymic lymphoma	
MNU-3-3-11	208/118		
MNU-3-2-10	220/130	Thymic lymphoma	

**Group MNU-4 (C3H)**

[Age at the cessation of injections: 95 days/Injected doses: 5-6 mg/animal]

Animal ID	Survival/Post-IP (day)	Histopathology	
		Lymphoid Neoplasms	Other Tumors
MNU-4-1-1	132/37	Thymic lymphoma	
MNU-4-1-2	141/46	Thymic lymphoma	
MNU-4-1-3	143/48		
MNU-4-1-4	149/54		
MNU-4-2-1	149/54		
MNU-4-1-5	151/56	Thymic lymphoma	
MNU-4-1-6	151/56		
MNU-4-2-2	155/60		
MNU-4-2-3	157/62		
MNU-4-3-1	158/63		
MNU-4-2-4	159/64		
MNU-4-3-2	159/64		
MNU-4-1-7	162/67	Thymic lymphoma	
MNU-4-2-5	162/67	Thymic lymphoma	
MNU-4-3-3	162/67	Lymphoma	
MNU-4-3-4	163/68		
MNU-4-2-6	164/69		
MNU-4-3-5	164/69		
MNU-4-3-6	165/70		
MNU-4-3-7	165/70		
MNU-4-1-8	170/75		
MNU-4-1-9	171/76		
MNU-4-3-8	172/77		
MNU-4-1-10	173/78		
MNU-4-3-9	173/78		
MNU-4-2-7	175/80		
MNU-4-2-8	175/80		
MNU-4-3-10	175/80		
MNU-4-2-9	176/81		
MNU-4-2-10	176/81		
MNU-4-1-11	176/81		

**Group MNU-5 (C57)**

[Age at the cessation of injections: 98 days/Injected doses: 5-6 mg/animal]

Animal ID	Survival/Post-IP (day)	Histopathology	
		Lymphoid Neoplasms	Other Tumors
MNU-5-2-1	107/9		
MNU-5-1-1	116/18		
MNU-5-1-2	132/34	Thymic lymphoma	
MNU-5-2-2	141/43	Lymphoma	
MNU-5-1-3	144/46	Thymic lymphoma	
MNU-5-1-4	146/48	Lymphoma	
MNU-5-1-5	146/48		
MNU-5-1-6	148/50	Thymic lymphoma	
MNU-5-1-7	148/50	Thymic lymphoma	
MNU-5-2-3	148/50	Thymic lymphoma	
MNU-5-2-4	150/52	Thymic lymphoma	
MNU-5-2-5	150/52		
MNU-5-3-1	151/53	Thymic lymphoma	
MNU-5-3-2	152/54		
MNU-5-2-6	153/55	Thymic lymphoma	
MNU-5-2-7	153/55		
MNU-5-3-3	153/55	Thymic lymphoma	
MNU-5-2-8	155/57	Thymic lymphoma	
MNU-5-2-9	157/59		
MNU-5-3-4	158/60	Thymic lymphoma	
MNU-5-2-10	159/61		
MNU-5-1-8	160/62		
MNU-5-1-9	161/63	Lymphoma	
MNU-5-3-5	163/65	Thymic lymphoma	
MNU-5-3-6	163/65	Thymic Lymphoma	
MNU-5-1-10	166/68		
MNU-5-1-11	168/70		
MNU-5-3-7	168/70		
MNU-5-3-8	169/71	Thymic lymphoma	
MNU-5-3-9	170/72	Thymic lymphoma	
MNU-5-3-10	170/72	Thymic lymphoma	

**Group MNU-6 (BC3)**

[Age at the cessation of injections: 99 days/Injected doses: 5-6 mg/animal]

Animal ID	Survival/Post-IP (day)	Histopathology	
		Lymphoid Neoplasms	Other Tumors
MNU-6-2-1	148/49	Thymic lymphoma	Stomach squamous cell carcinoma
MNU-6-1-1	159/60	Thymic lymphoma	
MNU-6-2-2	159/60	Thymic lymphoma	
MNU-6-2-3	164/65	Thymic lymphoma	
MNU-6-3-1	169/70		
MNU-6-2-4	170/71	Thymic lymphoma	
MNU-6-1-2	171/72	Thymic lymphoma	
MNU-6-2-5	172/73		
MNU-6-2-6	173/74	Thymic lymphoma	
MNU-6-2-7	176/77	Thymic lymphoma	
MNU-6-1-3	178/79	Thymic lymphoma	
MNU-6-1-4	"	Thymic lymphoma	
MNU-6-1-5	"		
MNU-6-2-8	"	Thymic lymphoma	
MNU-6-3-2	180/81	Thymic lymphoma	
MNU-6-3-3	183/84		
MNU-6-2-9	185/86		
MNU-6-1-6	185/86	Thymic lymphoma	
MNU-6-3-4	194/95	Thymic lymphoma	
MNU-6-3-5	196/97	Thymic lymphoma	
MNU-6-3-6	"	Thymic lymphoma	
MNU-6-3-7	201/102	Lymphoma	
MNU-6-1-7	204/105	Thymic lymphoma	
MNU-6-1-8	216/117	Thymic lymphoma	
MNU-6-3-8	224/125	Thymic lymphoma	
MNU-6-1-9	233/134	Thymic lymphoma	
MNU-6-3-9	238/139		
MNU-6-2-10	289/190		
MNU-6-1-10	318/219		
MNU-6-3-10	355/256		
MNU-6-1-11	488/389		Lung adenoma

### 3.2.3 Experimental Groups for $\gamma$ -ray Irradiation

#### Groups of Control Animals

The control groups of unirradiated animals for whole-body  $\gamma$ -irradiation as listed below correspond to each of experimental groups of  $\gamma$ -irradiated animals (Groups  $\gamma$ -1 to  $\gamma$ -6), respectively.

#### Control Groups for $\gamma$ -1 & $\gamma$ -4 (C3H)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Other Tumors
$\gamma$ -1-Ct-2-1	636/(551)	Lymphoma(T-LBL)	
$\gamma$ -1-Ct-1-1	774/(689)		
$\gamma$ -1-Ct-2-2	809/(724)		
$\gamma$ -1-Ct-1-2	825/(740)		
$\gamma$ -1-Ct-1-3	855/(770)		
$\gamma$ -1-Ct-1-4	855/(770)		
$\gamma$ -1-Ct-1-5	858/(773)		
$\gamma$ -1-Ct-1-6	858/(773)		
$\gamma$ -1-Ct-2-3	859/(774)		
$\gamma$ -1-Ct-2-4	904/(819)		
$\gamma$ -1-Ct-2-5	907/(822)		
$\gamma$ -1-Ct-2-6	928/(843)		
$\gamma$ -4-Ct-1-1	763/(678)	Liver tumor Lymphoma SC Carcinoma	Mam.adenocarcinoma SC tumor
$\gamma$ -4-Ct-2-1	820/(735)		
$\gamma$ -4-Ct-2-2	890/(805)		
$\gamma$ -4-Ct-1-2	902/(817)		
$\gamma$ -4-Ct-1-3	908/(823)		
$\gamma$ -4-Ct-2-3	915/(830)		
$\gamma$ -4-Ct-2-4	915/(830)		
$\gamma$ -4-Ct-2-5	921/(836)		
$\gamma$ -4-Ct-1-4	949/(864)		
$\gamma$ -4-Ct-1-5	951/(866)		
$\gamma$ -4-Ct-1-6	951/(866)		
$\gamma$ -4-Ct-2-6	951/(866)		

### Control Groups for $\gamma$ -2 & $\gamma$ -5 (C57)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Other Tumors
$\gamma$ -2-Ct-2-1	546/(458)	Myeloid leukemia	
$\gamma$ -2-Ct-2-2	689/(601)	Lymphoma	
$\gamma$ -2-Ct-1-1	764/(676)		
$\gamma$ -2-Ct-1-2	845/(757)	Histiocytic sarcoma	
$\gamma$ -2-Ct-1-3	848/(760)		
$\gamma$ -2-Ct-1-4	882/(794)		
$\gamma$ -2-Ct-1-5	882/(794)	Histiocytic sarcoma	
$\gamma$ -2-Ct-1-6	897/(809)		
$\gamma$ -2-Ct-2-3	927/(839)	Histiocytic sarcoma	
$\gamma$ -2-Ct-2-4	963/(875)	Lymphoma ?	
$\gamma$ -2-Ct-2-5	994/(906)		
$\gamma$ -2-Ct-2-6	1015/(927)		Mammary adenoma
$\gamma$ -5-Ct-1-1	526/(438)	Thymic (T-) Lymphoma	
$\gamma$ -5-Ct-1-2	561/(473)	Myeloid Leukemia	
$\gamma$ -5-Ct-1-3	700/(612)	Lymphoma ?	
$\gamma$ -5-Ct-2-1	737/(649)	Thymic Lymphoma	
$\gamma$ -5-Ct-1-4	767/(679)		
$\gamma$ -5-Ct-2-2	827/(739)		
$\gamma$ -5-Ct-1-5	837/(749)		
$\gamma$ -5-Ct-2-3	897/(809)		
$\gamma$ -5-Ct-1-6	902/(814)		
$\gamma$ -5-Ct-2-4	921/(833)	meta.SC fibrous histiocytoma	
$\gamma$ -5-Ct-2-5	960/(872)	Lymphoma	
$\gamma$ -5-Ct-2-6	970/(882)		Pulmonary adenocarcinoma

### Control Groups for $\gamma$ -3 & $\gamma$ -6(BC3)

Animal ID	Survival (day)	Histopathology	
		Fatal Tumors	Other Tumors
$\gamma$ -3-Ct-2-1	745/(657)		Mam.adenocarcinoma
$\gamma$ -3-Ct-2-2	756/(668)		Hemangioma
$\gamma$ -3-Ct-2-3	792/(704)	Lymphoma	
$\gamma$ -3-Ct-2-4	800/(712)		
$\gamma$ -3-Ct-1-1	891/(803)	Lymphoma	
$\gamma$ -3-Ct-1-2	952/(864)	Lymphoma ?	
$\gamma$ -3-Ct-1-3	1016/(928)	Lymphoma	
$\gamma$ -3-Ct-1-4	1072/(984)		
$\gamma$ -3-Ct-1-5	1093/(1005)		SC Hemangiosarcoma
$\gamma$ -3-Ct-1-6	1134/(1046)	Lymphoma ?	SCT ?
$\gamma$ -3-Ct-2-5	1138/(1050)		SC Hemangiosarcoma
$\gamma$ -3-Ct-2-6	1178/(1090)	Lymphoma ?	
$\gamma$ -6-Ct-2-1	685/(598)	Myeloid leukemia	
$\gamma$ -6-Ct-1-1	772/(685)	Lymphoma	
$\gamma$ -6-Ct-1-2	839/(752)	Lymphoma	
$\gamma$ -6-Ct-1-3	856/(769)	meta.Mam.squamous cell Ca	
$\gamma$ -6-Ct-1-4	860/(773)		
$\gamma$ -6-Ct-2-2	875/(788)		
$\gamma$ -6-Ct-1-5	896/(809)	Lymphoma	
$\gamma$ -6-Ct-2-3	944/(857)	Lymphoma?	
$\gamma$ -6-Ct-2-4	1028/(941)		Mam.adenocarcinoma
$\gamma$ -6-Ct-1-6	1070/(983)	Lymphoma	Mam.adenoma
$\gamma$ -6-Ct-2-5	1077/(990)	Pulmonary adenocarcinoma	SC fibrosarcoma
$\gamma$ -6-Ct-2-6	1210/(1123)	Lymphoma	SC fibrosarcoma



## Groups of $\gamma$ -Irradiated Animals

The experimental groups of whole-body  $\gamma$ -irradiated animals as listed below include the Groups  $\gamma$ -1 to  $\gamma$ -6 of three strains of mice, and the information on the experimental regimens including the age of animals at irradiation and the total doses, is attached to the head of the table for each group, respectively.

### Group $\gamma$ -1 (C3H)

[Age at irradiation: 85 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -1-1-3-1	1.0	541/456		Ov.tumor
$\gamma$ -1-1-4-1	"	606/521		
$\gamma$ -1-1-3-2	"	636/551		
$\gamma$ -1-1-4-2	"	655/570		Ov.tumor
$\gamma$ -1-1-2-1	"	669/584	Uterus sarcoma	Ov.tumor(granulosa cell tumor)
$\gamma$ -1-1-6-1	"	672/587		Ov.cystadenoma
$\gamma$ -1-1-6-2	"	753/668		SC fibrosarcoma
$\gamma$ -1-1-1-1	"	788/703		SCFS/OvT
$\gamma$ -1-1-1-2	"	802/717	meta.Mammary adenocarcinoma	
$\gamma$ -1-1-5-1	"	811/726		HCAD
$\gamma$ -1-1-3-3	"	816/731		Ovary tumor
$\gamma$ -1-1-5-2	"	823/738		
$\gamma$ -1-1-5-3	"	823/738		
$\gamma$ -1-1-1-3	"	825/740		Pulmonary adenoma
$\gamma$ -1-1-1-4	"	834/749		
$\gamma$ -1-1-5-4	"	839/754		SC adenocarcinoma
$\gamma$ -1-1-5-5	"	841/756		Mammary adenocarcinoma
$\gamma$ -1-1-4-3	"	847/762		
$\gamma$ -1-1-2-2	"	848/763		
$\gamma$ -1-1-3-4	"	851/766		SC tumor/Ovary tumor
$\gamma$ -1-1-3-5	"	851/766		
$\gamma$ -1-1-4-4	"	851/766		HCAD/PAD
$\gamma$ -1-1-4-5	"	853/768		
$\gamma$ -1-1-6-3	"	853/768		
$\gamma$ -1-1-6-4	"	858/773		
$\gamma$ -1-1-1-5	"	858/773		
$\gamma$ -1-1-2-3	"	921/836		
$\gamma$ -1-1-2-4	"	924/839		
$\gamma$ -1-1-6-5	"	924/839		OvT/MAD
$\gamma$ -1-1-2-5	"	942/857		

**Group  $\gamma$ -1 (C3H; Cont'd)**

[Age at irradiation: 85 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -1-2-4-1	2.0	539/454		Ov.adenocarcinoma
$\gamma$ -1-2-6-1	"	574/489		
$\gamma$ -1-2-3-1	"	603/518		
$\gamma$ -1-2-5-1	"	610/525		(hepatic nodular adenoma)
$\gamma$ -1-2-1-1	"	638/553		
$\gamma$ -1-2-2-1	"	676/591		
$\gamma$ -1-2-6-2	"	680/595		Thyroid carcinoma
$\gamma$ -1-2-3-2	"	711/626		
$\gamma$ -1-2-1-2	"	714/629		Ov.granulosa cell tumor
$\gamma$ -1-2-4-2	"	720/635		Ov.granulosa cell tumor
$\gamma$ -1-2-6-3	"	725/640		
$\gamma$ -1-2-4-3	"	732/647	meta.Liposarcoma	
$\gamma$ -1-2-4-4	"	736/651		
$\gamma$ -1-2-1-3	"	739/654		
$\gamma$ -1-2-2-2	"	753/668		SC fibrosarcoma
$\gamma$ -1-2-5-2	"	763/678		Mammary adenocarcinoma
$\gamma$ -1-2-5-3	"	782/697		SC hemangiosarcoma/OvCa
$\gamma$ -1-2-3-3	"	802/717		
$\gamma$ -1-2-6-4	"	830/745		Hemangiosarcoma
$\gamma$ -1-2-4-5	"	832/747		
$\gamma$ -1-2-3-4	"	840/755		SC sarcoma
$\gamma$ -1-2-3-5	"	851/766		
$\gamma$ -1-2-2-3	"	851/766		
$\gamma$ -1-2-2-4	"	854/769		
$\gamma$ -1-2-2-5	"	855/770		
$\gamma$ -1-2-1-4	"	862/777		
$\gamma$ -1-2-5-4	"	886/801		Ov.granulosa cell tumor
$\gamma$ -1-2-5-5	"	886/801		Ov.granulosa cell tumor
$\gamma$ -1-2-6-5	"	886/801		
$\gamma$ -1-2-1-5	"	888/803		SC fibrosarcoma

**Group  $\gamma$ -1 (C3H; Cont'd)**  
[Age at irradiation: 85 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -1-3-1-1	3.0	372/287		
$\gamma$ -1-3-2-1	"	316/231	Lymphoid leukemia	
$\gamma$ -1-3-3-1	"	523/438	meta.Osteosarcoma	
$\gamma$ -1-3-4-1	"	343/258	Lymphoma	
$\gamma$ -1-3-4-2	"	557/472		SC sarcoma
$\gamma$ -1-3-5-1	"	501/416		
$\gamma$ -1-3-6-1	"	526/441	meta.Osteosarcoma	
$\gamma$ -1-3-1-2	"	564/479		
$\gamma$ -1-3-3-2	"	564/479		Hemangioma
$\gamma$ -1-3-4-3	"	581/496		
$\gamma$ -1-3-5-2	"	594/509	meta.Ovary dysgerminoma	focal osteofibrosarcoma
$\gamma$ -1-3-6-2	"	609/524		Hepatocellular carcinoma
$\gamma$ -1-3-6-3	"	648/563		
$\gamma$ -1-3-5-3	"	662/577	Ov.tumor(dysgerminoma)	
$\gamma$ -1-3-2-2	"	677/592	meta.Mammary adenocarcinoma	
$\gamma$ -1-3-3-3	"	683/598		
$\gamma$ -1-3-2-3	"	685/600	Lymphoma(PreB)	Hepatocellular adenoma
$\gamma$ -1-3-1-3	"	704/619		
$\gamma$ -1-3-1-4	"	711/626		
$\gamma$ -1-3-6-4	"	742/657		SC liposarcoma
$\gamma$ -1-3-2-4	"	749/664		Hepatocellular adenocarcinoma
$\gamma$ -1-3-4-4	"	766/681		
$\gamma$ -1-3-6-5	"	788/703		
$\gamma$ -1-3-5-4	"	791/706		Pulmonary adenoma
$\gamma$ -1-3-2-5	"	802/717		
$\gamma$ -1-3-3-4	"	809/724		
$\gamma$ -1-3-5-5	"	810/725		
$\gamma$ -1-3-1-5	"	839/754		
$\gamma$ -1-3-3-5	"	851/766		PAD
$\gamma$ -1-3-4-5	"	882/797		SC fibrosarcoma

**Group  $\gamma$ -2 (C57)**

[Age at irradiation: 88 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -2-1-5-1	1.0	539/451		
$\gamma$ -2-1-6-1	"	652/564		Hepatic adenoma
$\gamma$ -2-1-3-1	"	680/592	Histiocytic sarcoma	
$\gamma$ -2-1-4-1	"	686/598	Thymic lymphoma	
$\gamma$ -2-1-3-2	"	701/613		
$\gamma$ -2-1-6-2	"	722/634		
$\gamma$ -2-1-5-2	"	732/644		
$\gamma$ -2-1-3-3	"	736/648		SC fibroma
$\gamma$ -2-1-5-3	"	744/656	Lymphoma	
$\gamma$ -2-1-3-4	"	756/668		
$\gamma$ -2-1-5-4	"	772/684	Lymphoma	
$\gamma$ -2-1-4-2	"	777/689	Renal carcinoma	
$\gamma$ -2-1-4-3	"	777/689		
$\gamma$ -2-1-6-3	"	778/690	Histiocytic sarcoma	
$\gamma$ -2-1-1-1	"	788/700	Lymphoma(T-LCL)	
$\gamma$ -2-1-6-4	"	791/703		
$\gamma$ -2-1-4-4	"	808/720		
$\gamma$ -2-1-1-2	"	812/724		Lymphoma
$\gamma$ -2-1-2-1	"	826/738	Hemangiosarcoma	
$\gamma$ -2-1-1-3	"	829/741		
$\gamma$ -2-1-1-4	"	841/753		
$\gamma$ -2-1-2-2	"	847/759	meta.Hemangiosarcoma	
$\gamma$ -2-1-3-5	"	847/759		Ovary tumor ?
$\gamma$ -2-1-4-5	"	861/773		
$\gamma$ -2-1-5-5	"	875/787		
$\gamma$ -2-1-2-3	"	882/794		
$\gamma$ -2-1-1-5	"	896/808	Histiocytic sarcoma	
$\gamma$ -2-1-6-5	"	903/815		
$\gamma$ -2-1-2-4	"	1001/913		
$\gamma$ -2-1-2-5	"	1003/915	Lymphoma	

**Group  $\gamma$ -2 (C57; Cont'd)**  
[Age at irradiation: 88 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -2-2-1-1	2.0	266/178		
$\gamma$ -2-2-3-1	"	441/353	Thymic lymphoma ?	
$\gamma$ -2-2-3-2	"	568/480		
$\gamma$ -2-2-3-3	"	632/544	Lymphoma(T-LBL)	Ov.dysgerminoma
$\gamma$ -2-2-2-1	"	672/584		
$\gamma$ -2-2-1-2	"	673/585	Lymphoma(T-LCL)	
$\gamma$ -2-2-2-2	"	679/591		
$\gamma$ -2-2-1-3	"	721/633	Lymphoma	
$\gamma$ -2-2-6-1	"	728/640	systemic Hemangiosarcoma	
$\gamma$ -2-2-5-1	"	738/650		
$\gamma$ -2-2-2-3	"	742/654		
$\gamma$ -2-2-1-4	"	744/656	Lymphoma	
$\gamma$ -2-2-2-4	"	763/675		Pulmonary adenoma
$\gamma$ -2-2-4-1	"	763/675	Lymphoma ?	
$\gamma$ -2-2-3-4	"	770/682	Lymphoma(T-LBL)	
$\gamma$ -2-2-6-2	"	793/705	meta.Mandibular carcinoma	
$\gamma$ -2-2-6-3	"	799/711	meta.Kidney carcinoma	
$\gamma$ -2-2-4-2	"	819/731		Ovary tumor
$\gamma$ -2-2-4-3	"	840/752		
$\gamma$ -2-2-5-2	"	842/754		
$\gamma$ -2-2-5-3	"	847/759		
$\gamma$ -2-2-6-4	"	858/770		Pulmonary adenoma
$\gamma$ -2-2-5-4	"	868/780		
$\gamma$ -2-2-4-4	"	885/797	Myeloid leukemia	
$\gamma$ -2-2-4-5	"	931/843		
$\gamma$ -2-2-6-5	"	931/843		
$\gamma$ -2-2-2-5	"	959/871		
$\gamma$ -2-2-3-5	"	973/885		
$\gamma$ -2-2-1-5	"	991/903		

**Group  $\gamma$ -2 (C57; Cont'd)**

[Age at irradiation: 88 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -2-3-1-1	3.0	344/256	Lymphoma	Harderian gl. carcinoma
$\gamma$ -2-3-2-1	"	491/403	Lymphoma ?	
$\gamma$ -2-3-2-2	"	546/458	Lymphoma	
$\gamma$ -2-3-3-1	"	558/470	Lymphoma?	
$\gamma$ -2-3-4-1	"	563/475	Lymphoma	
$\gamma$ -2-3-5-1	"	423/335	Lymphoma	
$\gamma$ -2-3-6-1	"	406/318		
$\gamma$ -2-3-1-2	"	599/511		
$\gamma$ -2-3-1-3	"	604/516	Lymphoma	
$\gamma$ -2-3-3-2	"	609/521	Lymphoma	
$\gamma$ -2-3-3-3	"	623/535	Lymphoma ?	
$\gamma$ -2-3-4-2	"	659/571	Leukemic lymphoma(T-LCL)	
$\gamma$ -2-3-4-3	"	680/592	meta.Osteosarcoma	
$\gamma$ -2-3-6-2	"	686/598	Thymic lymphoma	
$\gamma$ -2-3-2-3	"	693/605		
$\gamma$ -2-3-5-2	"	701/613	Myeloid leukemia	
$\gamma$ -2-3-5-3	"	717/629		
$\gamma$ -2-3-4-4	"	730/642	Histiocytic sarcoma(leukemic)	
$\gamma$ -2-3-3-4	"	736/648		
$\gamma$ -2-3-1-4	"	770/682	Lymphoma(T-LBL)	
$\gamma$ -2-3-5-4	"	773/685		
$\gamma$ -2-3-5-5	"	808/720		
$\gamma$ -2-3-4-5	"	821/733		
$\gamma$ -2-3-6-3	"	863/775	Histiocytic sarcoma	
$\gamma$ -2-3-3-5	"	870/782		
$\gamma$ -2-3-6-4	"	913/825		
$\gamma$ -2-3-1-5	"	939/851	Histiocytic sarcoma	
$\gamma$ -2-3-6-5	"	983/895	Histiocytic sarcoma	
$\gamma$ -2-3-2-5	"	1036/948		

**Group  $\gamma$ -3 (BC3)**

[Age at irradiation: 88 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -3-1-1-1	1.0	388/300		
$\gamma$ -3-1-2-1	"	428/340	Lymphoma	
$\gamma$ -3-1-3-1	"	592/504	Systemic Hemangiosarcoma	
$\gamma$ -3-1-5-1	"	623/535		
$\gamma$ -3-1-1-2	"	644/556		
$\gamma$ -3-1-2-2	"	659/571	meta.SC fibrosarcoma	
$\gamma$ -3-1-6-1	"	660/572	meta.Ovary dysgerminoma	
$\gamma$ -3-1-5-2	"	668/580	SC fibrosarcoma	
$\gamma$ -3-1-1-3	"	672/584	Lymphoma(B-SLL)	
$\gamma$ -3-1-2-3	"	695/607	Pulmonary adenocarcinoma	Splenic hemangioma
$\gamma$ -3-1-6-2	"	697/609	Lymphoma	
$\gamma$ -3-1-2-4	"	714/626	Myeloid leukemia	
$\gamma$ -3-1-3-2	"	770/682	Hemangiosarcoma	
$\gamma$ -3-1-4-1	"	793/705	Lymphoma	Ov.granulosa cell tumor
$\gamma$ -3-1-3-3	"	819/731	meta.SC fibrosarcoma	
$\gamma$ -3-1-6-3	"	836/748		SC fibrosarcoma
$\gamma$ -3-1-4-2	"	854/766	Histiocytic sarcoma	
$\gamma$ -3-1-5-3	"	863/775	meta.Abd.fibrosarcoma	
$\gamma$ -3-1-3-4	"	869/781	Myeloid leukemia	
$\gamma$ -3-1-1-4	"	872/784	Lymphoma	
$\gamma$ -3-1-1-5	"	917/829	meta.Ovary tumor	
$\gamma$ -3-1-5-4	"	934/846		SC tumor
$\gamma$ -3-1-4-3	"	938/850	SC fibrosarcoma	
$\gamma$ -3-1-4-4	"	953/865	SC fibrosarcoma	
$\gamma$ -3-1-3-5	"	959/871	HCC	PAD
$\gamma$ -3-1-4-5	"	973/885	Ov. tumor	PAC
$\gamma$ -3-1-5-5	"	980/892		Ovary adenocarcinoma
$\gamma$ -3-1-6-4	"	981/893	Lymphoma	Harderian gland adenoma
$\gamma$ -3-1-6-5	"	984/896	meta.Ovary tumor	Mammary adenocarcinoma
$\gamma$ -3-1-2-5	"	996/908	Hepatocellular carcinoma	Ovary tumor

**Group  $\gamma$ -3 (BC3; Cont'd)**

[Age at irradiation: 88 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -3-2-2-1	2.0	357/269	Lymphoma	
$\gamma$ -3-2-4-1	"	539/451	Leukemia	
$\gamma$ -3-2-5-1	"	462/374		Basal cell Ca
$\gamma$ -3-2-6-1	"	518/430		
$\gamma$ -3-2-4-2	"	598/510	Lymphoma(Pre-B)	
$\gamma$ -3-2-1-1	"	624/536	met.Hemangiosarcoma	Myeloid(granuocytic) leukemia
$\gamma$ -3-2-3-1	"	652/564	meta.SC liposarcoma	
$\gamma$ -3-2-5-2	"	665/577		Pulmonary adenoma
$\gamma$ -3-2-6-2	"	723/635	meta.Ovary tumor	
$\gamma$ -3-2-3-2	"	735/647	Brain tumor	Pulmonary adenocarcinoma
$\gamma$ -3-2-1-2	"	742/654		Pulmonary adenocarcinoma
$\gamma$ -3-2-5-3	"	742/654		Ovary granulosa cell tumor
$\gamma$ -3-2-4-3	"	749/661		
$\gamma$ -3-2-6-3	"	756/668	meta.Mammary adenocarcinoma	
$\gamma$ -3-2-2-2	"	770/682	meta.Hepatocellular carcinoma	
$\gamma$ -3-2-2-3	"	770/682	Lymphoma	
$\gamma$ -3-2-5-4	"	784/696		HCAD/OvT/Hemangioma
$\gamma$ -3-2-6-4	"	791/703	Leukemic lymphoma	HCC
$\gamma$ -3-2-1-3	"	805/717		SCT
$\gamma$ -3-2-1-4	"	833/745	Lymphoma	
$\gamma$ -3-2-4-4	"	833/745	Mammary adenocarcinoma	
$\gamma$ -3-2-1-5	"	834/766		
$\gamma$ -3-2-3-3	"	843/755	Abd.hemangiosarcoma	
$\gamma$ -3-2-6-5	"	854/766	meta.Liposarcoma	
$\gamma$ -3-2-3-4	"	875/787	meta.Ovary tumor	PAC
$\gamma$ -3-2-3-5	"	875/787		
$\gamma$ -3-2-2-4	"	877/789	meta.Ovary tumor	
$\gamma$ -3-2-4-5	"	889/801	Lymphoma	SC fibrosarcoma
$\gamma$ -3-2-2-5	"	948/860	HCC	Ov. tumor
$\gamma$ -3-2-5-5	"	966/878		SC fibrosarcoma



**Group  $\gamma$ -3 (BC3; Cont'd)**

[Age at irradiation: 88 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -3-3-1-1	3.0	469/381		
$\gamma$ -3-3-3-1	"	434/346	Lymphoma	
$\gamma$ -3-3-2-1	"	548/460	Leukemic lymphoma	
$\gamma$ -3-3-2-2	"	581/493		
$\gamma$ -3-3-1-2	"	585/497	Mam.adenocarcinoma	Hepatocellular adenoma
$\gamma$ -3-3-4-1	"	609/521		
$\gamma$ -3-3-1-3	"	616/528	Myeloid leukemia	
$\gamma$ -3-3-1-4	"	665/577		Ovary tumor
$\gamma$ -3-3-3-2	"	666/578		Thyroid carcinoma
$\gamma$ -3-3-6-1	"	668/580	meta.Harderian gl.adenocarcinoma	
$\gamma$ -3-3-3-3	"	699/611		SC fibrosarcoma
$\gamma$ -3-3-5-1	"	730/642	meta.Carcinoma	
$\gamma$ -3-3-1-5	"	739/651	meta.Ovary tumor	
$\gamma$ -3-3-2-3	"	739/651		SC fibrosarcoma
$\gamma$ -3-3-4-2	"	742/654		
$\gamma$ -3-3-5-2	"	742/654	Lymphoma	
$\gamma$ -3-3-2-4	"	749/661		Ovary tumor
$\gamma$ -3-3-6-2	"	777/689	meta.Harderian carcinoma	
$\gamma$ -3-3-4-3	"	784/696		HCAD/PAC
$\gamma$ -3-3-5-3	"	795/707		
$\gamma$ -3-3-4-4	"	818/730		Ovary tumor
$\gamma$ -3-3-6-3	"	818/730		
$\gamma$ -3-3-3-4	"	861/773		SC hemangiosarcoma
$\gamma$ -3-3-4-5	"	868/780		Ovary tumor ?
$\gamma$ -3-3-5-4	"	885/797		
$\gamma$ -3-3-2-5	"	921/833	Adrenal tumor	Osteosarcoma
$\gamma$ -3-3-6-4	"	946/858		SC fibrosarcoma
$\gamma$ -3-3-5-5	"	947/859	Histiocytic sarcoma	HCC
$\gamma$ -3-3-6-5	"	973/885	Abdominal tumor	
$\gamma$ -3-3-3-5	"	987/899	meta.Ovary carcinoma	Mammary adenocarcinoma

**Group  $\gamma$ -4 (C3H)**

[Age at irradiation: 85 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -4-1-1-1	1.0	622/537	Thymic lymphoma(T-LBL)	
$\gamma$ -4-1-3-1	"	634/549	Ov.tumor	
$\gamma$ -4-1-4-1	"	664/579	Lymphoma(T-LBL)	Pulm.adenoma
$\gamma$ -4-1-1-2	"	712/627	Mam.adenocarcinoma	
$\gamma$ -4-1-2-1	"	718/633	Ov.tumor	
$\gamma$ -4-1-5-1	"	721/636	meta.Osteosarcoma	
$\gamma$ -4-1-2-2	"	732/647		SCT?
$\gamma$ -4-1-2-3	"	743/658		SC fibrosarcoma
$\gamma$ -4-1-5-2	"	745/660		Ovary granulosa cell tumor
$\gamma$ -4-1-2-4	"	757/672		Mammary adenocarcinoma
$\gamma$ -4-1-1-3	"	769/684	SC fibrosarcoma	Mammary adenoma
$\gamma$ -4-1-5-3	"	774/689		Ovary tumor
$\gamma$ -4-1-4-2	"	781/696	Ovary adenocarcinoma	
$\gamma$ -4-1-5-4	"	795/710		SC tumor
$\gamma$ -4-1-6-1	"	806/721		SC tumor
$\gamma$ -4-1-2-5	"	811/726		
$\gamma$ -4-1-1-4	"	815/730		
$\gamma$ -4-1-1-5	"	820/735		
$\gamma$ -4-1-5-5	"	837/752		
$\gamma$ -4-1-3-2	"	853/768		
$\gamma$ -4-1-4-3	"	860/775		
$\gamma$ -4-1-6-2	"	865/780		
$\gamma$ -4-1-4-4	"	886/801		
$\gamma$ -4-1-4-5	"	893/808		Ovary tumor
$\gamma$ -4-1-6-3	"	900/815		Mammary carcinoma
$\gamma$ -4-1-6-4	"	907/822		
$\gamma$ -4-1-6-5	"	914/829		SC tumor/PAD
$\gamma$ -4-1-3-3	"	957/872		
$\gamma$ -4-1-3-4	"	965/880		
$\gamma$ -4-1-3-5	"	965/880		SC sarcoma

**Group  $\gamma$ -4 (C3H; Cont'd)**

[Age at irradiation: 85 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -4-2-2-1	2.0	512/427		
$\gamma$ -4-2-6-1	"	518/433	meta.Osteosarcoma	
$\gamma$ -4-2-6-2	"	627/542		
$\gamma$ -4-2-5-1	"	652/567		
$\gamma$ -4-2-1-1	"	692/607		
$\gamma$ -4-2-5-2	"	699/614		
$\gamma$ -4-2-3-2	"	711/626		
$\gamma$ -4-2-5-3	"	713/628		
$\gamma$ -4-2-2-2	"	713/628	meta.Adrenal carcinoma	
$\gamma$ -4-2-2-3	"	729/644		SC Adenocarcinoma
$\gamma$ -4-2-4-1	"	732/647		
$\gamma$ -4-2-1-2	"	755/670	meta.Mammary carcinoma	
$\gamma$ -4-2-4-2	"	755/670		SC adenocarcinoma/Thyroid Ca
$\gamma$ -4-2-3-3	"	767/682		SC fibrosarcoma
$\gamma$ -4-2-3-4	"	774/689		
$\gamma$ -4-2-1-3	"	776/691	Mammary fibrosarcoma	
$\gamma$ -4-2-4-3	"	789/704		
$\gamma$ -4-2-1-4	"	795/710		
$\gamma$ -4-2-2-4	"	819/734		
$\gamma$ -4-2-4-4	"	820/735	Histiocytic sarcoma	
$\gamma$ -4-2-2-5	"	824/739		Ovary adenocarcinoma
$\gamma$ -4-2-1-5	"	837/752		Abdominal fibrosarcoma
$\gamma$ -4-2-5-4	"	837/752	Hepatocellular carcinoma	
$\gamma$ -4-2-6-3	"	848/763		Ov.granulosa cell tumor
$\gamma$ -4-2-5-5	"	872/787		
$\gamma$ -4-2-3-5	"	883/798		Ovary tumor/HGT
$\gamma$ -4-2-4-5	"	888/803		
$\gamma$ -4-2-6-4	"	900/815		
$\gamma$ -4-2-6-5	"	927/842		

**Group  $\gamma$ -4 (C3H; Cont'd)**

[Age at irradiation: 85 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -4-3-1-1	3.0	405/320		
$\gamma$ -4-3-3-1	"	490/405	Lymphoid leukemia	
$\gamma$ -4-3-6-1	"	223/138		
$\gamma$ -4-3-6-2	"	511/426		Ov.granulosa tumor
$\gamma$ -4-3-5-1	"	554/469	Lymphatic Leukemia	
$\gamma$ -4-3-4-1	"	563/478	meta. Osteosarcoma	(Liv.adenomatous nodule)
$\gamma$ -4-3-4-2	"	575/490		Mam.adenocarcinoma
$\gamma$ -4-3-2-1	"	599/514		Hep.adenoma
$\gamma$ -4-3-5-2	"	599/514		Ov.dysgerminoma
$\gamma$ -4-3-2-1	"	599/514		
$\gamma$ -4-3-5-3	"	620/535		
$\gamma$ -4-3-6-3	"	643/558		Parathyroid adenocarcinoma
$\gamma$ -4-3-5-4	"	678/593		
$\gamma$ -4-3-2-2	"	679/594		
$\gamma$ -4-3-1-2	"	680/595		Adrenal pheochromocytoma
$\gamma$ -4-3-3-2	"	714/629		Mam.adenocarcinoma
$\gamma$ -4-3-1-3	"	726/641		
$\gamma$ -4-3-2-3	"	732/647		Ov.tumor ?
$\gamma$ -4-3-6-4	"	743/658		Mam.adenocarcinoma
$\gamma$ -4-3-2-4	"	764/679		Adrenal carcinoma
$\gamma$ -4-3-2-5	"	767/682		Mam.adenocarcinoma
$\gamma$ -4-3-3-3	"	770/685	Lymphoma	Mam.adenocarcinoma
$\gamma$ -4-3-3-4	"	809/724	meta.Mammary carcinoma	
$\gamma$ -4-3-4-3	"	809/724		Ovary tumor
$\gamma$ -4-3-6-5	"	810/725	meta.Thyroid carcinoma	Ovary tumor/pulmonary AC
$\gamma$ -4-3-3-5	"	816/731		
$\gamma$ -4-3-4-4	"	816/731		
$\gamma$ -4-3-4-5	"	823/738		
$\gamma$ -4-3-1-4	"	837/752		Adrenal tumor
$\gamma$ -4-3-1-5	"	848/763		Ov.granulosa cell tumor
$\gamma$ -4-3-5-5	"	879/794		Mammary adenocarcinoma

**Group  $\gamma$ -5 (C57)**

[Age at irradiation: 88 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -5-1-1-1	1	518/430		Liposarcoma
$\gamma$ -5-1-2-1	"	574/486	Myeloid leukemia	
$\gamma$ -5-1-1-2	"	599/511	Lymphoma	
$\gamma$ -5-1-6-1	"	623/535	Thymic lymphoma	
$\gamma$ -5-1-4-1	"	651/563		
$\gamma$ -5-1-5-1	"	653/565	Myeloid(Gr.) leukemia	
$\gamma$ -5-1-4-2	"	683/595	Osteosarcoma	
$\gamma$ -5-1-1-3	"	687/599	Lymphoma	
$\gamma$ -5-1-2-2	"	708/620	Histiocytic sarcoma	Pancreatic islet carcinoma
$\gamma$ -5-1-1-4	"	714/626		
$\gamma$ -5-1-6-2	"	764/676		
$\gamma$ -5-1-3-1	"	773/685		
$\gamma$ -5-1-3-2	"	784/696		
$\gamma$ -5-1-1-5	"	792/704		Hepatocellular adenoma
$\gamma$ -5-1-3-3	"	799/711	Histiocytic sarcoma	Ovary adenocarcinoma
$\gamma$ -5-1-4-3	"	802/714	Urinary bladder tumor	SC hemangioma
$\gamma$ -5-1-2-3	"	835/747		Localized lymphoma
$\gamma$ -5-1-6-3	"	847/759		
$\gamma$ -5-1-6-4	"	847/759		
$\gamma$ -5-1-3-4	"	872/784		
$\gamma$ -5-1-5-2	"	902/814	Lymphoma	
$\gamma$ -5-1-6-5	"	910/822		
$\gamma$ -5-1-5-3	"	917/829		
$\gamma$ -5-1-5-4	"	917/829		
$\gamma$ -5-1-5-5	"	917/829	Lymphoma	
$\gamma$ -5-1-2-4	"	995/907		
$\gamma$ -5-1-4-4	"	998/910	Histiocytic sarcoma	Pulmonary adenocarcinoma
$\gamma$ -5-1-4-5	"	1001/913		
$\gamma$ -5-1-3-5	"	1002/914		
$\gamma$ -5-1-2-5	"	1015/927		Pulmonary adenoma

**Group  $\gamma$ -5 (C57; Cont'd)**

[Age at irradiation: 88 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -5-2-6-1	2	575/487	meta.Osteosarcoma	Pulm.adenoma
$\gamma$ -5-2-5-1	"	588/500	Lymphoma(T-LCL)	
$\gamma$ -5-2-6-2	"	640/552	Leukemic Lymphoma(B-SLL)	
$\gamma$ -5-2-6-3	"	658/570	Myeloid(Gr.) leukemia	SC Hemangiosarcoma
$\gamma$ -5-2-2-1	"	665/577		
$\gamma$ -5-2-4-1	"	667/579	Hemangiosarcoma	
$\gamma$ -5-2-1-1	"	693/605		
$\gamma$ -5-2-1-2	"	696/608	Lymphoma	
$\gamma$ -5-2-2-2	"	711/623		Pulmonary adenoma
$\gamma$ -5-2-5-2	"	715/627	Thymic lymphoma	
$\gamma$ -5-2-3-1	"	728/640		
$\gamma$ -5-2-3-2	"	728/640		PAC
$\gamma$ -5-2-4-2	"	746/658		
$\gamma$ -5-2-2-3	"	772/684		
$\gamma$ -5-2-2-4	"	792/704		SC tumor
$\gamma$ -5-2-3-3	"	805/717		
$\gamma$ -5-2-5-3	"	812/724	meta.Hemangiosarcoma	
$\gamma$ -5-2-1-3	"	819/731	Lymphoma ?	Ov. adenocarcinoma
$\gamma$ -5-2-5-4	"	829/741		
$\gamma$ -5-2-6-4	"	837/749	Lymphoma	
$\gamma$ -5-2-6-5	"	868/780		
$\gamma$ -5-2-3-4	"	882/794		
$\gamma$ -5-2-4-3	"	882/794	Ovary tumor	
$\gamma$ -5-2-2-5	"	913/825		
$\gamma$ -5-2-3-5	"	927/839		
$\gamma$ -5-2-1-4	"	931/843		
$\gamma$ -5-2-1-5	"	980/892		
$\gamma$ -5-2-4-4	"	990/902		
$\gamma$ -5-2-4-5	"	996/908		
$\gamma$ -5-2-5-5	"	1015/927		

**Group  $\gamma$ -5 (C57; Cont'd)**

[Age at irradiation: 88 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -5-3-1-1	3.0	472/384	Myeloid leukemia ?	
$\gamma$ -5-3-2-1	"	434/346	Myeloid leukemia	
$\gamma$ -5-3-2-2	"	442/354	Lymphoma	
$\gamma$ -5-3-5-1	"	238/150		
$\gamma$ -5-3-5-2	"	408/320	Lymphoma	
$\gamma$ -5-3-3-1	"	540/452	Leukemic Lymphoma	
$\gamma$ -5-3-3-2	"	546/458		
$\gamma$ -5-3-2-3	"	569/481	Lymphoma(Pre-B)	Pulm.adenoma
$\gamma$ -5-3-6-1	"	578/490	Myeloid Neoplasm	
$\gamma$ -5-3-3-3	"	588/500		Ov.adenocarcinoma
$\gamma$ -5-3-3-4	"	665/577	Liver histiocytic sarcoma	
$\gamma$ -5-3-6-2	"	683/595		
$\gamma$ -5-3-3-5	"	693/605	Lymphoma ?	
$\gamma$ -5-3-5-3	"	742/654		
$\gamma$ -5-3-4-1	"	746/658		
$\gamma$ -5-3-4-2	"	763/675		
$\gamma$ -5-3-1-2	"	770/682		
$\gamma$ -5-3-1-3	"	782/694	Histiocytic sarcoma	
$\gamma$ -5-3-2-4	"	784/696		
$\gamma$ -5-3-1-4	"	808/720		PAC
$\gamma$ -5-3-4-3	"	809/721		
$\gamma$ -5-3-6-3	"	814/726		Localized lymphoma
$\gamma$ -5-3-2-5	"	829/741		
$\gamma$ -5-3-1-5	"	857/769		
$\gamma$ -5-3-6-4	"	858/770		
$\gamma$ -5-3-6-5	"	872/784		
$\gamma$ -5-3-4-4	"	876/788		
$\gamma$ -5-3-4-5	"	882/794		
$\gamma$ -5-3-5-4	"	886/798		
$\gamma$ -5-3-5-5	"	900/812	meta.Carcinoma	

**Group  $\gamma$ -6 (BC3)**

[Age at irradiation: 87 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -6-1-1-1	1.0	527/440	Lymphoma	
$\gamma$ -6-1-4-1	"	581/494	S.lymphocytic leukemia	
$\gamma$ -6-1-4-2	"	671/584		SC fibrosarcoma
$\gamma$ -6-1-3-1	"	684/597		
$\gamma$ -6-1-3-2	"	713/626		
$\gamma$ -6-1-4-3	"	715/628		
$\gamma$ -6-1-2-1	"	741/654		
$\gamma$ -6-1-3-3	"	741/654	Lymphoma ?	
$\gamma$ -6-1-5-1	"	741/654		SC sarcoma
$\gamma$ -6-1-4-4	"	759/672		SC fibrosarcoma
$\gamma$ -6-1-5-2	"	762/675		Pulmonary adenoma
$\gamma$ -6-1-1-2	"	770/683	meta.Ovary tumor	
$\gamma$ -6-1-1-3	"	771/684		
$\gamma$ -6-1-2-2	"	776/689	Lymphoma?	PAD
$\gamma$ -6-1-5-3	"	783/696		
$\gamma$ -6-1-2-3	"	808/721	Myeloid leukemia	
$\gamma$ -6-1-1-4	"	820/733	meta.SC fibrosarcoma	
$\gamma$ -6-1-1-5	"	886/779		
$\gamma$ -6-1-5-4	"	870/783	Lymphoma	
$\gamma$ -6-1-6-1	"	870/783	Lymphoma ?	
$\gamma$ -6-1-3-4	"	902/815	SC fibrosarcoma	
$\gamma$ -6-1-3-5	"	909/822	Ov. tumor	SC fibrosarcoma/Mam. AC
$\gamma$ -6-1-6-2	"	925/838	meta.SC fibrosarcoma	
$\gamma$ -6-1-6-3	"	931/844	Lymphoma	Ovary tumor
$\gamma$ -6-1-6-4	"	931/844	Ovary tumor	
$\gamma$ -6-1-5-5	"	938/851		
$\gamma$ -6-1-6-5	"	954/867	Lymphoma	HCC/Ovary carcinoma ?
$\gamma$ -6-1-4-5	"	965/878	Ovary tumor	
$\gamma$ -6-1-2-4	"	993/906	Lymphoma ?	
$\gamma$ -6-1-2-5	"	1086/999		Ovary tumor



**Group  $\gamma$ -6 (BC3; Cont'd)**

[Age at irradiation: 87 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -6-2-1-1	2.0	321/234		
$\gamma$ -6-2-5-1	"	281/194	Lymphoma	
$\gamma$ -6-2-4-1	"	512/425	Thymic Lymphoma	
$\gamma$ -6-2-6-1	"	686/599	Myeloid leukemia	Pulmonary adenoma
$\gamma$ -6-2-4-2	"	694/607		
$\gamma$ -6-2-6-2	"	702/615	Pancreatic carcinoma	
$\gamma$ -6-2-5-2	"	722/635	Lymphoma	
$\gamma$ -6-2-4-3	"	728/641	meta.SC fibrosarcoma	
$\gamma$ -6-2-1-2	"	734/647	meta.Harderian gl.tumor	
$\gamma$ -6-2-4-4	"	734/647	Hepatocellular carcinoma	
$\gamma$ -6-2-6-3	"	741/654		Harderian gl.carcinoma
$\gamma$ -6-2-2-1	"	748/661		Pulmonary adenocarcinoma?
$\gamma$ -6-2-3-2	"	751/664	Lymphoma	
$\gamma$ -6-2-2-2	"	755/668	meta.Mammary carcinoma	
$\gamma$ -6-2-1-3	"	776/689		
$\gamma$ -6-2-6-4	"	787/700	Lymphoma	
$\gamma$ -6-2-5-3	"	797/710		OvT
$\gamma$ -6-2-3-3	"	819/732		Lymphoma?
$\gamma$ -6-2-2-3	"	835/748		Ovary tumor/Thyroid carcinoma
$\gamma$ -6-2-5-4	"	839/752	Lymphoma	OvT/PAD
$\gamma$ -6-2-3-4	"	840/753		
$\gamma$ -6-2-5-5	"	842/755	meta.Uterus tumor	
$\gamma$ -6-2-1-4	"	853/766	Lymphoma ?	Pulmonary adenocarcinoma
$\gamma$ -6-2-1-5	"	877/790	SC carcinoma	PAC
$\gamma$ -6-2-2-4	"	881/794		
$\gamma$ -6-2-6-5	"	902/815		localized Lymphoma ?
$\gamma$ -6-2-4-5	"	912/825	Lymphoma ?	SC adenocarcinoma
$\gamma$ -6-2-3-5	"	930/843	Histiocytic sarcoma	
$\gamma$ -6-2-2-5	"	1014/927	meta.Hepatocellular Ca	Pulmonary adenocarcinoma

**Group  $\gamma$ -6 (BC3; Cont'd)**

[Age at irradiation: 87 days/Total doses: 1.0-3.0 Gy]

Animal ID	Dose (Gy)	Survival/Post- $\gamma$ (day)	Histopathology	
			Fatal Tumors	Other Tumors
$\gamma$ -6-3-1-1	3.0	301/214		
$\gamma$ -6-3-2-1	"	398/311	Lymphoma	
$\gamma$ -6-3-5-1	"	325/238		Ov.granulosa cell tumor
$\gamma$ -6-3-5-2	"	451/364	Lymphoma	
$\gamma$ -6-3-4-1	"	489/402		
$\gamma$ -6-3-4-2	"	524/437		
$\gamma$ -6-3-6-1	"	561/474		
$\gamma$ -6-3-3-1	"	563/476		Osteosarcoma
$\gamma$ -6-3-5-3	"	574/487	metastatic Osteosarcoma	
$\gamma$ -6-3-6-2	"	608/521		
$\gamma$ -6-3-1-2	"	629/542	HCC	
$\gamma$ -6-3-3-2	"	660/573		Ovary tumor
$\gamma$ -6-3-6-3	"	661/574	Lymphoma	
$\gamma$ -6-3-4-3	"	664/577	Lymphoma	
$\gamma$ -6-3-5-4	"	665/578	SC fibrosarcoma	Ov.granulosa cell tumor
$\gamma$ -6-3-5-5	"	668/581		Liposarcoma
$\gamma$ -6-3-1-3	"	671/584		
$\gamma$ -6-3-4-4	"	673/586	meta.Harderian adenocarcinoma	
$\gamma$ -6-3-3-3	"	693/606	Lymphoma	Ov.carcinoma/PAC
$\gamma$ -6-3-3-4	"	720/633		
$\gamma$ -6-3-2-2	"	745/658	Lymphoma	
$\gamma$ -6-3-6-4	"	745/658	Pulmonary adenocarcinoma	HC adenoma
$\gamma$ -6-3-3-5	"	755/668	meta.Ovary tumor	
$\gamma$ -6-3-4-5	"	762/675		Mammary adenocarcinoma
$\gamma$ -6-3-2-3	"	765/678	meta.Harderian carcinoma	
$\gamma$ -6-3-1-4	"	772/685	Lymphoma	PAD/Hem.tumor
$\gamma$ -6-3-1-5	"	793/706	meta.HCC	
$\gamma$ -6-3-6-5	"	828/741	HCC	Ovary tumor
$\gamma$ -6-3-2-4	"	832/745	Lymphoma	Ovary tumor
$\gamma$ -6-3-2-5	"	959/872		Mammary adenocarcinoma

## Non-Neoplastic Lesions from the Groups of $\gamma$ -Irradiated and Control Animals

Histopathological findings on non-neoplastic lesions from the experimental groups of  $\gamma$ -irradiated and control animals (Groups  $\gamma$ -1 to  $\gamma$ -6 of three strains of mice) are summarized for individual cases. The tables as below contain the information on the dose, survival period, and histopathological diagnosis of non-neoplastic lesions and neoplasms in each case.

### Group $\gamma$ -1 (C3H)

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -1-Ct-2-1	0	636/(551)	Brain demyelination     Myocardial fibrosis  Spinal demyelination ? Liv.fatty degeneration	Lymphoma
$\gamma$ -1-Ct-1-1	"	774/(689)		
$\gamma$ -1-Ct-2-2	"	809/(724)		
$\gamma$ -1-Ct-1-2	"	825/(740)		
$\gamma$ -1-Ct-1-3	"	855/(770)		
$\gamma$ -1-Ct-1-4	"	855/(770)		
$\gamma$ -1-Ct-1-5	"	858/(773)		
$\gamma$ -1-Ct-1-6	"	858/(773)		
$\gamma$ -1-Ct-2-3	"	859/(774)		
$\gamma$ -1-Ct-2-4	"	904/(819)		
$\gamma$ -1-Ct-2-5	"	907/(822)		
$\gamma$ -1-Ct-2-6	"	928/(843)		
$\gamma$ -1-1-3-1	1	541/456	Atrophy/lung hyperemia/spinal deg. & demyelin. Atrophy without nervous lesions Skeletal osteopetrotic trabeculare Kid.urinary cyst     Kid.glomerul.atrophy & urinary casts Trabecular bone growth & BM fibrosis Sp.necrosis Pan.islet slight hypertrophy  Myocardial fibrosis   	

**Group  $\gamma$ -1 (C3H; Cont'd)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -1-2-4-1	2	539/454	Liver massive necrosis	OvAC
$\gamma$ -1-2-6-1	"	574/489		
$\gamma$ -1-2-3-1	"	603/518		
$\gamma$ -1-2-5-1	"	610/525	Atrophy	Liver nodular AD
$\gamma$ -1-2-1-1	"	638/553	Sp.marginal zone amyloidosis	
$\gamma$ -1-2-2-1	"	676/591	Atrophy	
$\gamma$ -1-2-6-2	"	680/595	Liv.Pit & brilliant cells/lung edema/spinal deg.	Thyroid AC
$\gamma$ -1-2-3-2	"	711/626		
$\gamma$ -1-2-1-2	"	714/629	Pancreas lymphocytic inflt.	Ovary tumor
$\gamma$ -1-2-4-2	"	720/635	Liv.nod.hyperplasia/Heart pericardial Ca dep.	Ovary tumor
$\gamma$ -1-2-6-3	"	725/640	autolysis	
$\gamma$ -1-2-4-3	"	732/647		meta.Liposarcoma
$\gamma$ -1-2-4-4	"	736/651	Myocardial calcification	
$\gamma$ -1-2-1-3	"	739/654	Liv.fatty deg.	
$\gamma$ -1-2-2-2	"	753/668	Lung hemorrhage & hemosiderin-phagocytes	SC fibrosarcoma
$\gamma$ -1-2-5-2	"	763/678		Mam.adenocarcinoma
$\gamma$ -1-2-5-3	"	782/697		SCHemSa/OvT
$\gamma$ -1-2-3-3	"	802/717		
$\gamma$ -1-2-6-4	"	830/745		Hemangiosarcoma
$\gamma$ -1-2-4-5	"	832/747	Liv.fatty deg./Pan.islet hypertrophy/BM.trabecul.gr.	
$\gamma$ -1-2-3-4	"	840/755		SC sarcoma
$\gamma$ -1-2-3-5	"	851/766	Pan.islet hypertrophy/Tr.bone growth	
$\gamma$ -1-2-2-3	"	851/766	Liv.regeneration/Kid.infarct	
$\gamma$ -1-2-2-4	"	854/769		
$\gamma$ -1-2-2-5	"	855/770	BM trabecular bone growth	
$\gamma$ -1-2-1-4	"	862/777	Liv.nodular hyperplasia	
$\gamma$ -1-2-5-4	"	886/801		OvT
$\gamma$ -1-2-5-5	"	886/801		OvT
$\gamma$ -1-2-6-5	"	886/801		
$\gamma$ -1-2-1-5	"	888/803		

**Group  $\gamma$ -1 (C3H; Cont'd)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -1-3-2-1	3	316/231	Lung hyperemia/no nervous lesions	Leuk.Lymphoma
$\gamma$ -1-3-4-1	"	343/258		G.Lymphoma
$\gamma$ -1-3-1-1	"	372/287		
$\gamma$ -1-3-5-1	"	501/416		
$\gamma$ -1-3-3-1	"	523/438		mOS/OvT
$\gamma$ -1-3-6-1	"	526/441		mOS
$\gamma$ -1-3-4-2	"	557/472		SCsarcoma
$\gamma$ -1-3-1-2	"	564/479	Kidney interst.lymphoid inflt. Liver vacuolar & fatty deg.	Hemangioma
$\gamma$ -1-3-3-2	"	564/479		
$\gamma$ -1-3-4-3	"	581/496		
$\gamma$ -1-3-5-2	"	594/509	Liver fatty drop.& vacuol.deg./Kidney gl.mesang. enl.	mOvT
$\gamma$ -1-3-6-2	"	609/524	Lung hyperemia/myocardial edema	HCC
$\gamma$ -1-3-6-3	"	648/563	Liv.necrosis/cardiac arteriolar hyalin. & swelling Kid.glom.swell./myocard.edemoa & arteriolar swell.	OvT mMam.AC
$\gamma$ -1-3-5-3	"	662/577		
$\gamma$ -1-3-2-2	"	677/592		
$\gamma$ -1-3-3-3	"	683/598	Pan.islet atrophy/pericardial fibrosis & mineraliz.	Lymphoma/Hep.AD
$\gamma$ -1-3-2-3	"	685/600		
$\gamma$ -1-3-1-3	"	704/619		
$\gamma$ -1-3-1-4	"	711/626	Kid.slight interst.fibrosis & lym.inflt.	SC liposarcoma HCAC
$\gamma$ -1-3-6-4	"	742/657		
$\gamma$ -1-3-2-4	"	749/664		
$\gamma$ -1-3-4-4	"	766/681	Sp.G-G-like body/Lung alv.eosin.crystalline	PAD
$\gamma$ -1-3-6-5	"	788/703		
$\gamma$ -1-3-5-4	"	791/706		
$\gamma$ -1-3-2-5	"	802/717	BM trabecular bone growth	PAD SC fibrosarcoma
$\gamma$ -1-3-3-4	"	809/724		
$\gamma$ -1-3-5-5	"	810/725		
$\gamma$ -1-3-1-5	"	839/754		
$\gamma$ -1-3-3-5	"	851/766		
$\gamma$ -1-3-4-5	"	882/797		

**Group  $\gamma$ -2 (C57)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -2-Ct-2-1	0	546/(458)		Myeloid leukemia
$\gamma$ -2-Ct-2-2	"	689/(601)	Kid.glom.hyal. & amyloid dep.	Lymphoma
$\gamma$ -2-Ct-1-1	"	764/(676)	Pancreas lym.inflt./Kid urinary casts	
$\gamma$ -2-Ct-1-2	"	845/(757)	Kid.glom.hyal.&mes.increase/Lg.embolism	Hist.sarcoma
$\gamma$ -2-Ct-1-3	"	848/(760)	Kid.hydroneph.glom.hyaliniz./Lg.eosin.crystall.	
$\gamma$ -2-Ct-1-4	"	882/(794)	Lg.alveolar eosinophilic deposits	
$\gamma$ -2-Ct-1-5	"	882/(794)	Lg.alveolar eosinophilic crystalline	
$\gamma$ -2-Ct-1-6	"	897/(809)	Liv.hypertrophy/Lg.alveolar eos.crystall.	
$\gamma$ -2-Ct-2-3	"	927/(839)	Liv.fatty deg.necros./Kid.Bowmans thick.	Histiocytic sarcoma
$\gamma$ -2-Ct-2-4	"	963/(875)		Lymphoma?
$\gamma$ -2-Ct-2-5	"	994/(906)		
$\gamma$ -2-Ct-2-6	"	1015/(927)	Liv.hypertrophy/Kid.lym.inflt./Lg.eos.sub.crystall.	Mammary adenoma
$\gamma$ -2-1-5-1	1	539/451		
$\gamma$ -2-1-6-1	"	652/564	Liv.fatty deg./Kid.glomer.hyalin., plasma cell inflt.	Hepatocellular AD
$\gamma$ -2-1-3-1	"	680/592		Histiocytic sarcoma
$\gamma$ -2-1-4-1	"	686/598	Liv.fatty droplet deg.	Thymic lymphoma
$\gamma$ -2-1-3-2	"	701/613	Liv.lym.aggr./Kid.int.fibr.&glomer.nephritis	
$\gamma$ -2-1-6-2	"	722/634	Liv.lym.inflt./Pan islet hypertrophy/Lg.eos.depos.	
$\gamma$ -2-1-5-2	"	732/644	Pan.lym.inflt/Kid glomer.hyal.&mesang.increase	
$\gamma$ -2-1-3-3	"	736/648	Pan.int.lym.inflt./Kid.glom.capillary hyalin.lym.inflt.	SC fibroma
$\gamma$ -2-1-5-3	"	744/656	autolysis	Lymphoma
$\gamma$ -2-1-3-4	"	756/668	Lung alveolar eosinophilic substances	
$\gamma$ -2-1-5-4	"	772/684		Lymphoma
$\gamma$ -2-1-4-2	"	777/689	Lung alveolar eosinophilic crystalline/BM fibrosis	Renal carcinoma
$\gamma$ -2-1-4-3	"	777/689		
$\gamma$ -2-1-6-3	"	778/690		Histiocytic sarcoma
$\gamma$ -2-1-1-1	"	788/700		Lymphoma
$\gamma$ -2-1-6-4	"	791/703	Lung alveolar eosinophilic crystalline	
$\gamma$ -2-1-4-4	"	808/720	Lung alveolar eosinophilic crystalline	
$\gamma$ -2-1-1-2	"	812/724	Liv.fatty deg./Lung alveolar eosinophilic crystalline	Lymphoma
$\gamma$ -2-1-2-1	"	826/738	Kid.glom.hyaliniz./Alv.eos.crystalline/BM fibrosis	Hemangioma
$\gamma$ -2-1-1-3	"	829/741		
$\gamma$ -2-1-1-4	"	841/753	Lg.slight eosinophilic crystalline	
$\gamma$ -2-1-2-2	"	847/759	Pan.int.lym.inflt.	meta.Hemangiosarcoma
$\gamma$ -2-1-3-5	"	847/759		Ovary tumor
$\gamma$ -2-1-4-5	"	861/773		
$\gamma$ -2-1-5-5	"	875/787	Lg.alveolar eosinophilic depts.	
$\gamma$ -2-1-2-3	"	882/794		
$\gamma$ -2-1-1-5	"	896/808		Histiocytic sarcoma
$\gamma$ -2-1-6-5	"	903/815	Lg.alveolar eosinophilic crystalline	
$\gamma$ -2-1-2-4	"	1001/913		
$\gamma$ -2-1-2-5	"	1003/915		Lymphoma

**Group  $\gamma$ -2 (C57; Cont'd)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -2-2-1-1	2	266/178		
$\gamma$ -2-2-3-1	"	441/353		Thymic lymphoma
$\gamma$ -2-2-3-2	"	568/480	Liv.granuloma/Kid.glom.hyal.&mesang.sclerosis	
$\gamma$ -2-2-3-3	"	632/544672		Lymphoma/Ov.tumor
$\gamma$ -2-2-2-1	"	/584		
$\gamma$ -2-2-1-2	"	673/585		Lymphoma
$\gamma$ -2-2-2-2	"	679/591		
$\gamma$ -2-2-1-3	"	721/633		Lymphoma
$\gamma$ -2-2-6-1	"	728/640	Kid.inter.nephritis/Lg.perivasc.inflt.	Hemangiosarcoma
$\gamma$ -2-2-5-1	"	738/650	Perivascu.lym.inflt/Lg.eosin.sub. dep.	
$\gamma$ -2-2-2-3	"	742/654	autolysis	
$\gamma$ -2-2-1-4	"	744/656	autolysis	Lymphoma
$\gamma$ -2-2-2-4	"	763/675	Lung alveolar eosinophilic substances deposition	Pulmonary adenoma
$\gamma$ -2-2-4-1	"	763/675		Lymphoma ?
$\gamma$ -2-2-3-4	"	770/682		Lymphoma
$\gamma$ -2-2-6-2	"	793/705	Liv.lym.& PC inflt./Pan.interst.lym.inflt.	Mandibular Ca
$\gamma$ -2-2-6-3	"	799/711	Lung alveolar eosinophilic substances deposition	meta.Kid.Ca
$\gamma$ -2-2-4-2	"	819/731		Ov.tumor
$\gamma$ -2-2-4-3	"	840/752		
$\gamma$ -2-2-5-2	"	842/754		
$\gamma$ -2-2-5-3	"	847/759		
$\gamma$ -2-2-6-4	"	858/770	Liv.hep.hypertrophy/Kid.glom.hyal./Lg.alv.eos.cry.	Pulmonary adenoma
$\gamma$ -2-2-5-4	"	868/780	Kid.glomerular hyalinization	
$\gamma$ -2-2-4-4	"	885/797		Myeloid leukemia
$\gamma$ -2-2-4-5	"	931/843	Lung alveolar eosinophilic crystalline	
$\gamma$ -2-2-6-5	"	931/843	Kid.glom.hyalin./Myocard.edema/Alveol.eos.cryst.	
$\gamma$ -2-2-2-5	"	959/871	Liv.MNC agg./Kid.int.cell inflt./Lg.alv.eos.sub.	
$\gamma$ -2-2-3-5	"	973/885	Liv.fatty deg.	
$\gamma$ -2-2-1-5	"	991/903	Liv.hypertrophy, lym./Pan.MNC/Lg.eos.sub.dep.	

**Group  $\gamma$ -2 (C57; Cont'd)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -2-3-1-1	3	344/256		Lymphoma
$\gamma$ -2-3-6-1	"	406/318		
$\gamma$ -2-3-5-1	"	423/335		Lymphoma
$\gamma$ -2-3-2-1	"	491/403		Lymphoma
$\gamma$ -2-3-2-2	"	546/458	Kid.glom.hyalinization	Lymphoma
$\gamma$ -2-3-3-1	"	558/470		Lymphoma
$\gamma$ -2-3-4-1	"	563/475		Lymphoma
$\gamma$ -2-3-1-2	"	599/511	Coronary arterial medial thickeness	Harderian gl. AC
$\gamma$ -2-3-1-3	"	604/516		Lymphoma
$\gamma$ -2-3-3-2	"	609/521		Lymphoma
$\gamma$ -2-3-3-3	"	623/535	Liv.plasma cell inflt. & connect.tissue stroma	Lymphoma
$\gamma$ -2-3-4-2	"	659/571		Leukemic lymphoma
$\gamma$ -2-3-4-3	"	680/592		meta.OS
$\gamma$ -2-3-6-2	"	686/598		Thymic lymphoma
$\gamma$ -2-3-2-3	"	693/605	Kid.glom.swell. & mes.increase/Myocarditis	
$\gamma$ -2-3-5-2	"	701/613	Liv.fatty deg./Sp.G-G body/Glom.hyal.mes.depos.	Myeloid leukemia
$\gamma$ -2-3-5-3	"	717/629	CT inflamm./Sp. G-G body/Kid. glomer.scler.	
$\gamma$ -2-3-4-4	"	730/642	Kid glom.hyalin.& int.lym.inflt/Lg perivas.lym.inflt	Histiocytic sarcoma
$\gamma$ -2-3-3-4	"	736/648	Lg.alveol.eosin.crystal.amorphous substances depos.	
$\gamma$ -2-3-1-4	"	770/682		Lymphoma
$\gamma$ -2-3-5-4	"	773/685	Kid.glomer.hyaliniz./Connective tissue growth	
$\gamma$ -2-3-5-5	"	808/720		
$\gamma$ -2-3-4-5	"	821/733		
$\gamma$ -2-3-6-3	"	863/775	Lg.alveolar eosinophilic crystalline	Histiocytic sarcoma
$\gamma$ -2-3-3-5	"	870/782	Liv.swell.binucleat./Lg.alveolar eos.crystall.	
$\gamma$ -2-3-6-4	"	913/825	Lung alveolar eosinophilic deposit.	
$\gamma$ -2-3-1-5	"	939/851	Liv.endothel., Kupffer increase, hypertrophy	Histiocytic sarcoma
$\gamma$ -2-3-6-5	"	983/895	Lg.alveolar eosinophilic crystalline	Histiocytic sarcoma
$\gamma$ -2-3-2-5	"	1036/948	Bl.vessel wall hyalin./Kid.glom.scleros./Lg.eos.cryst.	



**Group γ-3 (BC3)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
γ-3-Ct-2-1	0	745/(657)	Pan.mononuclear cell inflt./Adipose lym.inflt.	Mam.adenocarcinoma
γ-3-Ct-2-2	"	756/(668)	Lung emboli/Heart coronary vessel swelling	Hemangioma
γ-3-Ct-2-3	"	792/(704)		Lymphoma
γ-3-Ct-2-4	"	800/(712)		
γ-3-Ct-1-1	"	891/(803)		Lymphoma
γ-3-Ct-1-2	"	952/(864)		Lymphoma ?
γ-3-Ct-1-3	"	1016/(928)	BM trabecular bone hyperplasia	Lymphoma
γ-3-Ct-1-4	"	1072/(984)	Liv.hypertr. & nod.hyperpl.fatty deg./Kid.glom.hyal.	
γ-3-Ct-1-5	"	1093/(1005)	Liv.swelling & fatty deg./Cardiac fibrosis	SC Hemangiosarcoma
γ-3-Ct-1-6	"	1134/(1046)	Lg.PAM & balloon cells	Lymphoma?/SCT?
γ-3-Ct-2-5	"	1138/(1050)	Liv.hypertrophy & fatty deg.	SC Hemangiosarcoma
γ-3-Ct-2-6	"	1178/(1090)	Myocardial PMN inflt.	Lymphoma ?
γ-3-1-1-1	1	388/300	Liv.fatty&vacuol.deg./Kid.glom.hyal.&scleros.	
γ-3-1-2-1	"	428/340	Liv.fatty deg. & necrosis	Lymphoma
γ-3-1-3-1	"	592/504	Liv.fatty deg.	Hemangiosarcoma
γ-3-1-5-1	"	623/535		
γ-3-1-1-2	"	644/556		
γ-3-1-2-2	"	659/571	Liv.fatty deg./Kid.glom.swell.mes.incr.lym.inflt.	met.SC fibrosarcoma
γ-3-1-6-1	"	660/572	Liv.fatty deg./Kid.glom.hyal.mes.dep.scler./vasculitis	Ov.tumor
γ-3-1-5-2	"	668/580	Kid.glom.swell.cap.deposit./Lg.cap.eosin.deposit.	SCfibrosarcoma
γ-3-1-1-3	"	672/584		Lymphoma
γ-3-1-2-3	"	695/607	Pan lym.inflt/Myocard.hemorrhage	Pulm.AC & sp.hemang.
γ-3-1-6-2	"	697/609		Lymphoma
γ-3-1-2-4	"	714/626	Kid.mesangium swelling/Alv.hemosiderin-laden Mφ	Myeloid leukemia
γ-3-1-3-2	"	770/682		Hemangiosarcoma
γ-3-1-4-1	"	793/705	Liv.fatty deg. & necrosis	Lymphoma/OvT
γ-3-1-3-3	"	819/731		meta.SC fibrosarcoma
γ-3-1-6-3	"	836/748		SC fibrosarcoma
γ-3-1-4-2	"	854/766		Histiocytic sarcoma
γ-3-1-5-3	"	863/775	Liv.fatty degeneration	Abd.fibrosarcoma
γ-3-1-3-4	"	869/781	Liv/fatty degeneration	Myeloid leukemia
γ-3-1-1-4	"	872/784		Lymphoma
γ-3-1-1-5	"	917/829		meta.OvT
γ-3-1-5-4	"	934/846		SC tumor
γ-3-1-4-3	"	938/850	Liv.fatty & vacuolar degeneration	SC fibrosarcoma
γ-3-1-4-4	"	953/865		SC fibrosarcoma
γ-3-1-3-5	"	959/871	Pan.plasma cell inflt.	HCC/PAD
γ-3-1-4-5	"	973/885		OvT/PAC
γ-3-1-5-5	"	980/892		Ov.adenocarcinoma
γ-3-1-6-4	"	981/893	BM fibrosis & trabecular bone hyperplasia	Lymphoma/HGAD
γ-3-1-6-5	"	984/896	Liv.nod.hyperplasia & fatty droplets	mOvT/MAC
γ-3-1-2-5	"	996/908	Pan.int.MNC inflt./Kid.MNC inflt.	HCC/OvT

**Group  $\gamma$ -3 (BC3; Cont'd)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -3-2-2-1	2	357/269		Lymphoma
$\gamma$ -3-2-5-1	"	462/374	Liv.fatty droplet	meta.SC basal cell T.
$\gamma$ -3-2-6-1	"	518/430		
$\gamma$ -3-2-4-1	"	539/451		Leukemia
$\gamma$ -3-2-4-2	"	598/510	Myocard.calcification	Lymphoma
$\gamma$ -3-2-1-1	"	624/536	Liv.amyloid./Kid.glom.scleros./Pancreatitis	Myel.Leuk./met.Hem.S.
$\gamma$ -3-2-3-1	"	652/564	Kid.int.lym.&plasma cell inflt.	met.SC liposarcoma
$\gamma$ -3-2-5-2	"	665/577		Pulm.AD
$\gamma$ -3-2-6-2	"	723/635	Fatty liver/Lung alveolar eosinophilic crystalline	meta.Ov.tumor
$\gamma$ -3-2-3-2	"	735/647	Liv.hepat. hypertrophy/Kid.Bowman's deposits	Brain tumor/PAC
$\gamma$ -3-2-1-2	"	742/654		PAC
$\gamma$ -3-2-5-3	"	742/654	Kid.mes.hypertrophy & increase/BM trabecular gr.	Ovary tumor
$\gamma$ -3-2-4-3	"	749/661	Liv.Glisson's PMN & lym.inflt.	
$\gamma$ -3-2-6-3	"	756/668	Liv.HC hypertrophy & fatty deg./Kid.mesang.swell.	meta.Mam.AC
$\gamma$ -3-2-2-2	"	770/682	Kid.glomerular hyalinization	meta.HCC
$\gamma$ -3-2-2-3	"	770/682	Lg.alveolar M $\phi$ phagocytosis of eosinophilic sub.	Lymphoma
$\gamma$ -3-2-5-4	"	784/696		HCAD/OvT/Hemangioma
$\gamma$ -3-2-6-4	"	791/703		Leuk.lymphoma/HCC
$\gamma$ -3-2-1-3	"	805/717		SCT
$\gamma$ -3-2-1-4	"	833/745		Lymphoma
$\gamma$ -3-2-4-4	"	833/745	Liv.fatty deg./Kid.mes.swell./Int.myocarditis	Mam.AC
$\gamma$ -3-2-1-5	"	834/746	Liv.fatty deg./BM fatty dep.	
$\gamma$ -3-2-3-3	"	843/755	Liv.vasc.hyalin./Pan.int.lym.inflt.	Abd.hemangiosarcoma
$\gamma$ -3-2-6-5	"	854/766	Kid.int.lym.inflt.	meta.Liposarcoma
$\gamma$ -3-2-3-4	"	875/787		meta.OvT/PAC
$\gamma$ -3-2-3-5	"	875/787	Liv.hypertrophy	
$\gamma$ -3-2-2-4	"	877/789	Bone trabecular thicken.	meta.OvT
$\gamma$ -3-2-4-5	"	889/801		Lymphoma/SCFS
$\gamma$ -3-2-2-5	"	948/860	Liv.necrosis/Myocardial PMN & lym.inflt.	HCC/OvT
$\gamma$ -3-2-5-5	"	966/878		SCFS

**Group  $\gamma$ -3 (BC3; Cont'd)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -3-3-3-1	3	434/346		Lymphoma
$\gamma$ -3-3-1-1	"	469/381	Kid.basophilic glom.& plasma cell inflt.	
$\gamma$ -3-3-2-1	"	548/460	Liv.fatty liver	Leukemic lymphoma
$\gamma$ -3-3-2-2	"	581/493	Fatty liv. & necr./Pancreatitis/Kid.int.cell inflt.	
$\gamma$ -3-3-1-2	"	585/497	Liv.fatty droplet/Pancreas islet hypertrophy	Hep.AD/Mam.AC
$\gamma$ -3-3-4-1	"	609/521	Fatty liv./Myocard.calcification & necrosis	
$\gamma$ -3-3-1-3	"	616/528	Fatty liv./Myocard.fibrosis/Lg.atelectasis	Myeloid leukemia
$\gamma$ -3-3-1-4	"	665/577		Ov.tumor
$\gamma$ -3-3-3-2	"	666/578		Thyroid Ca
$\gamma$ -3-3-6-1	"	668/580	Liv.ct.hyal./Sp.vasc.hyal./Pan.ct.hyal./Kid.glom.hyal.	meta.Harderian AC
$\gamma$ -3-3-3-3	"	699/611		SC fibrosarcoma
$\gamma$ -3-3-5-1	"	730/642	Kid.mesangial increase/Pan.islet hypertrophy	meta.Carcinoma
$\gamma$ -3-3-1-5	"	739/651	Kid.glom.capillary dilatation & mesangial increase	meta.Ovary tumor
$\gamma$ -3-3-2-3	"	739/651		SC fibrosarcoma
$\gamma$ -3-3-4-2	"	742/654	Liv.glysson's amyloidosis	
$\gamma$ -3-3-5-2	"	742/654		Lymphoma
$\gamma$ -3-3-2-4	"	749/661		Ovary tumor
$\gamma$ -3-3-6-2	"	777/689		meta.HGCa
$\gamma$ -3-3-4-3	"	784/696	Heart myocardial fibrosis & lym.inflt.	HCAD/PAC
$\gamma$ -3-3-5-3	"	795/707	Liv.necrosis & fatty deg./Sp.G-G body/Kid.gl.hyal.	
$\gamma$ -3-3-4-4	"	818/730	Liv.hypertrophy	Ovary tumor
$\gamma$ -3-3-6-3	"	818/730	Liv.fatty liver	
$\gamma$ -3-3-3-4	"	861/773	Liv.hypertrophy/Sp.necrosis	SC hemangiosarcoma
$\gamma$ -3-3-4-5	"	868/780	Liv.fatty degeneration	OvT ?
$\gamma$ -3-3-5-4	"	885/797	Liv.fatty degeneration & necrosis	
$\gamma$ -3-3-2-5	"	921/833	Liv.hypertrophy, reg., hyperplasia/Kid. Ca deposit.	Adr.tumor/Osteosarcoma
$\gamma$ -3-3-6-4	"	946/858	Liv.necr.fatty droplets/Lg.hemosiderin-laden MF	SC fibrosarcoma
$\gamma$ -3-3-5-5	"	947/859	Liv.necrosis & fatty degeneration	HCC/Histiocytic sarcoma
$\gamma$ -3-3-6-5	"	973/885		Abdominal tumor
$\gamma$ -3-3-3-5	"	987/899	Liv.nod.hyperplasia & fatty droplets	mOvCa/MAC

**Group  $\gamma$ -4 (C3H)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -4-Ct-1-1	0	763/(678)	Heart cardiomuscular fibrosis	
$\gamma$ -4-Ct-2-1	"	820/(735)	Pan.islet hypertrophy	
$\gamma$ -4-Ct-2-2	"	890/(805)	Myocarditis	
$\gamma$ -4-Ct-1-2	"	902/(817)		
$\gamma$ -4-Ct-1-3	"	908/(823)	Bone trabecular bone prolifer.	Mam.Carcinoma
$\gamma$ -4-Ct-2-3	"	915/(830)		
$\gamma$ -4-Ct-2-4	"	915/(830)		SC tumor
$\gamma$ -4-Ct-2-5	"	921/(836)	Liv.nod.hyperplasia/Pan.int.lym.inflt./Kid.Ca deposit.	Liver tumor
$\gamma$ -4-Ct-1-4	"	949/(864)		
$\gamma$ -4-Ct-1-5	"	951/(866)		Lymphoma
$\gamma$ -4-Ct-1-6	"	951/(866)		
$\gamma$ -4-Ct-2-6	"	951/(866)		SC carcinoma
$\gamma$ -4-1-1-1	1	622/537		Thymic lymphoma
$\gamma$ -4-1-3-1	"	634/549		Ov.tumor
$\gamma$ -4-1-4-1	"	664/579	Heart edema	Lymphoma/Pulm.AD
$\gamma$ -4-1-1-2	"	712/627		Mam.adenocarcinoma
$\gamma$ -4-1-2-1	"	718/633	Liv.sinusoidal enlargement	Ov.tumor
$\gamma$ -4-1-5-1	"	721/636		meta.Osteosarcoma
$\gamma$ -4-1-2-2	"	732/647		SCT?
$\gamma$ -4-1-2-3	"	743/658		SC fibrosarcoma
$\gamma$ -4-1-5-2	"	745/660	Cardiomuscular fibrosis/BM fibrosis & tr.bone growth	OvT
$\gamma$ -4-1-2-4	"	757/672		Mammary AC
$\gamma$ -4-1-1-3	"	769/684		SCFS/MAD
$\gamma$ -4-1-5-3	"	774/689	Trabecular bone gr. & BM fibrosis	Ovary tumor
$\gamma$ -4-1-4-2	"	781/696		Ovary AC
$\gamma$ -4-1-5-4	"	795/710		SC tumor
$\gamma$ -4-1-6-1	"	806/721		SC tumor
$\gamma$ -4-1-2-5	"	811/726	BM fibrosis	
$\gamma$ -4-1-1-4	"	815/730		
$\gamma$ -4-1-1-5	"	820/735		
$\gamma$ -4-1-5-5	"	837/752		
$\gamma$ -4-1-3-2	"	853/768		
$\gamma$ -4-1-4-3	"	860/775	Myocardial fibrosis	
$\gamma$ -4-1-6-2	"	865/780		
$\gamma$ -4-1-4-4	"	886/801		
$\gamma$ -4-1-4-5	"	893/808		
$\gamma$ -4-1-6-3	"	900/815		Mam.adenocarcinoma
$\gamma$ -4-1-6-4	"	907/822		
$\gamma$ -4-1-6-5	"	914/829		SC tumor/PAD
$\gamma$ -4-1-3-3	"	957/872	Adr.MN & round/ovoid cells	
$\gamma$ -4-1-3-4	"	965/880	Myocardial PMN inflt.	
$\gamma$ -4-1-3-5	"	965/880		SC sarcoma

**Group  $\gamma$ -4 (C3H; Cont'd)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -4-2-2-1	2	512/427		
$\gamma$ -4-2-6-1	"	518/433		met.OS
$\gamma$ -4-2-3-1	"	603/518		
$\gamma$ -4-2-6-2	"	627/542	Liv.nod.hyperplasia/BM hypoplasia & fat-replace.	
$\gamma$ -4-2-5-1	"	652/567	Lg.alveol.deposition of eosinophilic substances	
$\gamma$ -4-2-1-1	"	692/607	Pancreatitis with islets/Glomerulosclerosis with dep.	
$\gamma$ -4-2-5-2	"	699/614	Perivascular lym.inflt.	
$\gamma$ -4-2-3-2	"	711/626		
$\gamma$ -4-2-5-3	"	713/628	Kid.interst.fibrosis & glomerular hyaliniz.	
$\gamma$ -4-2-2-2	"	713/628	Myocardial fibrosis	meta.Adrenal Ca
$\gamma$ -4-2-2-3	"	729/644		SC Adenocarcinoma
$\gamma$ -4-2-4-1	"	732/647	Liv.sinusoidal endothel.proliferation	
$\gamma$ -4-2-1-2	"	755/670		meta.Mam.Ca.
$\gamma$ -4-2-4-2	"	755/670		SCAC/Thyroid Ca
$\gamma$ -4-2-3-3	"	767/682		SC fibrosarcoma
$\gamma$ -4-2-3-4	"	774/689		
$\gamma$ -4-2-1-3	"	776/691		Mam.fibrosarcoma
$\gamma$ -4-2-4-3	"	789/704	Myocardial necrosis & fibrosis/Trabecular bone prolif.	
$\gamma$ -4-2-1-4	"	795/710		
$\gamma$ -4-2-2-4	"	819/734	Liv.necrosis & vascular gr./Myocarditis/Pulm.hemor.	
$\gamma$ -4-2-4-4	"	820/735	Pan.&Sp.granuloma with giant cells/myocard.fibrosis	Histiocytic sarcoma
$\gamma$ -4-2-2-5	"	824/739		Ovary adenocarcinoma
$\gamma$ -4-2-1-5	"	837/752		Abdominal fibrosarcoma
$\gamma$ -4-2-5-4	"	837/752		Hepatocellular carcinoma
$\gamma$ -4-2-6-3	"	848/763	Liv.fatty degeneration/Sp.G-G body & vas.elongat.	PAD
$\gamma$ -4-2-5-5	"	872/787		
$\gamma$ -4-2-3-5	"	883/798		OvT/HGT
$\gamma$ -4-2-4-5	"	888/803		
$\gamma$ -4-2-6-4	"	900/815		
$\gamma$ -4-2-6-5	"	927/842		

**Group  $\gamma$ -4 (C3H; Cont'd)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -4-3-6-1	3	223/138		
$\gamma$ -4-3-1-1	"	405/320	Liv.focal necrosis & abscesses	
$\gamma$ -4-3-3-1	"	490/405	Liv.fatty deg.	Leuk.lymphoma
$\gamma$ -4-3-6-2	"	511/426		Ov.tumor
$\gamma$ -4-3-5-1	"	554/469		Leuk.lymphoma
$\gamma$ -4-3-4-1	"	563/478		OS
$\gamma$ -4-3-4-2	"	575/490		Mam.AC
$\gamma$ -4-3-2-1	"	599/514	Myocarditis/BM fibrosis	Hep.AD
$\gamma$ -4-3-5-2	"	599/514		Ov.tumor
$\gamma$ -4-3-5-3	"	620/535		
$\gamma$ -4-3-6-3	"	643/558		Parathyroid AC
$\gamma$ -4-3-5-4	"	678/593	BM fibrosis	
$\gamma$ -4-3-2-2	"	679/594	Panc.islet atrophy	
$\gamma$ -4-3-1-2	"	680/595	Panc.islet decrease	Adrenal tumor
$\gamma$ -4-3-3-2	"	714/629	BM fibrosis	Mam.adenocarcinoma
$\gamma$ -4-3-1-3	"	726/641	Liv.fatty deg. & necrosis	
$\gamma$ -4-3-2-3	"	732/647		Ov.tumor ?
$\gamma$ -4-3-6-4	"	743/658	Liv.focal necrosis/Sp.necrosis, hematoma	Mam.adenocarcinoma
$\gamma$ -4-3-2-4	"	764/679		Adrenal carcinoma
$\gamma$ -4-3-2-5	"	767/682		Mam.AC
$\gamma$ -4-3-3-3	"	770/685		Lymphoma/MAC
$\gamma$ -4-3-3-4	"	809/724		meta.MAC
$\gamma$ -4-3-4-3	"	809/724	Myocardial edema & slight fibrosis	Ovary tumor
$\gamma$ -4-3-6-5	"	810/725	Pan.islet hypertrophy, lym.inflt./BM trabecular gr.	Ovary T/Thyroid T/LT
$\gamma$ -4-3-3-5	"	816/731		
$\gamma$ -4-3-4-4	"	816/731		
$\gamma$ -4-3-4-5	"	823/738	Liv.hypertrophy & nodular hyperplasia	
$\gamma$ -4-3-1-4	"	837/752	Liv.fatty deg. & hypertrophy	Adrenal tumor
$\gamma$ -4-3-1-5	"	848/763		Ov.granulosa cell tumor
$\gamma$ -4-3-5-5	"	879/794		MAC

### Group $\gamma$ -5 (C57)

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -5-Ct-1-1	0	526/(438)	Lg. vascular edema	Thymic lymphoma
$\gamma$ -5-Ct-1-2	"	561/(473)		Myeloid leukemia
$\gamma$ -5-Ct-1-3	"	700/(612)		Lymphoma ?
$\gamma$ -5-Ct-2-1	"	737/(649)	Kid.mesangial increase & hyalinization Liv.fatty deg./Lg.alveolar eos.deposits Sp.arteriolar hyalinization	Thymic Lymphoma
$\gamma$ -5-Ct-1-4	"	767/(679)		
$\gamma$ -5-Ct-2-2	"	827/(739)		
$\gamma$ -5-Ct-1-5	"	837/(749)	Liv.fatty deg./Pan.MNC, amyloid/Kid.GNP	
$\gamma$ -5-Ct-2-3	"	897/(809)		
$\gamma$ -5-Ct-1-6	"	902/(814)		
$\gamma$ -5-Ct-2-4	"	921/(833)	Liv.fatty deg./Kid.glom.hyal./Eosinophilia	meta.SCFH
$\gamma$ -5-Ct-2-5	"	960/(872)	Liv.fatty deg. & necros./Lg.alv.eos.sub.& lym.inflt.	Lymphoma
$\gamma$ -5-Ct-2-6	"	970/(882)		PAC
$\gamma$ -5-1-1-1	1	518/430	Fatty liver	Liposarcoma
$\gamma$ -5-1-2-1	"	574/486	Liv.necrosis & fatty deg./Sp.G-G body	Myeloid leukemia
$\gamma$ -5-1-1-2	"	599/511	Kid.glom.hyalin. & subcap.infarct	Lymphoma
$\gamma$ -5-1-6-1	"	623/535	Lg.alveol.eosinophilic deposits Kid.glom.hyalin.cap.dilatation	Thymic lymphoma
$\gamma$ -5-1-4-1	"	651/563		
$\gamma$ -5-1-5-1	"	653/565		Myeloid leukemia
$\gamma$ -5-1-4-2	"	683/595	Thyroiditis? Lung alveolar eosinophilic sub. & phagocytosis Panc.islet MNC inflt. & destruction	Osteosarcoma
$\gamma$ -5-1-1-3	"	687/599		Lymphoma
$\gamma$ -5-1-2-2	"	708/620		Hist.sarcoma/Islet Ca
$\gamma$ -5-1-1-4	"	714/626	Kid.glom.hyalin. Myocardial lym.inflt. Myocardial fibrosis	
$\gamma$ -5-1-6-2	"	764/676		
$\gamma$ -5-1-3-1	"	773/685		
$\gamma$ -5-1-3-2	"	784/696	Liv.immature granulocyte inflt./hydronephrosis	HCAD
$\gamma$ -5-1-1-5	"	792/704		Histiocytic sarc./OvAC
$\gamma$ -5-1-3-3	"	799/711		UrBIT/SC hemangioma
$\gamma$ -5-1-4-3	"	802/714	Kid.glom.hyal./Lung alv.eos.deposit.	localized Lymphoma
$\gamma$ -5-1-2-3	"	835/747		
$\gamma$ -5-1-6-3	"	847/759		
$\gamma$ -5-1-6-4	"	847/759	Liv.fatty deg. & MNC/Kid.glom.hyal. & lym.inflt.	
$\gamma$ -5-1-3-4	"	872/784		
$\gamma$ -5-1-5-2	"	902/814		Lymphoma
$\gamma$ -5-1-6-5	"	910/822	Liv.hypertrophy/Lg.alv.eos.sub. & lym.inflt. Liv.necrosis/Lg.alv.eos.sub. & phagocyt. Lg.alv.eos.crystalline	
$\gamma$ -5-1-5-3	"	917/829		
$\gamma$ -5-1-5-4	"	917/829		Lymphoma
$\gamma$ -5-1-5-5	"	917/829	Liv.fatty deg.necr.MNC/Kid.necr.infarct & fibrosis Liv.MNC inflt./Kid.lym.inflt./Lg.MNC	
$\gamma$ -5-1-2-4	"	995/907		
$\gamma$ -5-1-4-4	"	998/910		Histiocytic S/PAC
$\gamma$ -5-1-4-5	"	1001/913		
$\gamma$ -5-1-3-5	"	1002/914		
$\gamma$ -5-1-2-5	"	1015/927		PAD

**Group  $\gamma$ -5 (C57; Cont'd)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -5-2-6-1	2	575/487	Kid.glom.swell.mes.vacuolar deg. & increase	met.OS
$\gamma$ -5-2-5-1	"	588/500	Kid.glom.hyal.mes.swell.	Lymphoma
$\gamma$ -5-2-6-2	"	640/552	Liv.fatty deg.	Leuk.lymphoma
$\gamma$ -5-2-6-3	"	658/570		Myeloid leukemia
$\gamma$ -5-2-2-1	"	665/577		
$\gamma$ -5-2-4-1	"	667/579	Pan lym.inflt & islet decrease/Kid lym.inflt	Hemangiosarcoma
$\gamma$ -5-2-1-1	"	693/605	Lung alveolar eosinophilic crystalline	
$\gamma$ -5-2-1-2	"	696/608	Lung alveolar eosinophilic substance deposition	Lymphoma
$\gamma$ -5-2-2-2	"	711/623		SC Hemangiosarcoma
$\gamma$ -5-2-5-2	"	715/627		Thymic lymphoma
$\gamma$ -5-2-3-1	"	728/640	Lung alveolar eosinophilic crystalline	
$\gamma$ -5-2-3-2	"	728/640		
$\gamma$ -5-2-4-2	"	746/658	Kid.glomer.hyalinization & mesang.increase	PAD
$\gamma$ -5-2-2-3	"	772/684	Liv.end.gr., fibrosis & hyalin./Kid.gl.hyal.	
$\gamma$ -5-2-2-4	"	792/704	Lg.eosinophilic crystalline & phagocytosis	
$\gamma$ -5-2-3-3	"	805/717	Kid.glomer.hyalin./Lg.alv.eos.deposits. & crystall.	PAC
$\gamma$ -5-2-5-3	"	812/724		meta.Hemangiosarcoma
$\gamma$ -5-2-1-3	"	819/731	Lg.alveolar eosinophilic crystalline	Lymphoma ?
$\gamma$ -5-2-5-4	"	829/741	Lg.alveolar eosinophilic deposits	
$\gamma$ -5-2-6-4	"	837/749		Lymphoma
$\gamma$ -5-2-6-5	"	868/780	Lung alveolar eosinophilic deposits	
$\gamma$ -5-2-3-4	"	882/794	Liv.hypertrophy, hyperplasia, fibrosis, PMN	
$\gamma$ -5-2-4-3	"	882/794	Pan.islet hypertrophy/Lg.bronch.PMN, lym.	SCT/OvT
$\gamma$ -5-2-2-5	"	913/825	Lg.alv.eos.crystalline/Myocardial granulocytic inflt.	
$\gamma$ -5-2-3-5	"	927/839	Liv.PMN,lym.,plasma/Pan.MNC/Lg.eos.sub.&lym.	
$\gamma$ -5-2-1-4	"	931/843	Lg.perivascular plasma cell inflt.	Ovary AC
$\gamma$ -5-2-1-5	"	980/892	Liv.fibrosis/Kid.int.lym.inflt.	
$\gamma$ -5-2-4-4	"	990/902	Liv.hypertrophy/Kid.lym.inflt./Lg.eos.sub. & lym.	
$\gamma$ -5-2-4-5	"	996/908	Liv.lym.PMN/Kid.lym./Myocard.endothel.fibrosis	
$\gamma$ -5-2-5-5	"	1015/927	Liv.nodular hyperplasia/Lg.alv.eos.crystalline	



**Group  $\gamma$ -5 (C57; Cont'd)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -5-3-5-1	3	238/150		
$\gamma$ -5-3-5-2	"	408/320		Lymphoma
$\gamma$ -5-3-2-1	"	434/346		Myeloid leukemia
$\gamma$ -5-3-2-2	"	442/354		Lymphoma
$\gamma$ -5-3-1-1	"	472/384	Liv.fatty deg./Kid.glom.hyal. & B.cap.fibrosis	Myeloid leukemia
$\gamma$ -5-3-3-1	"	540/452		Leuk.lymphoma
$\gamma$ -5-3-3-2	"	546/458		
$\gamma$ -5-3-2-3	"	569/481		Lymphoma/Pulm.AD
$\gamma$ -5-3-6-1	"	578/490		Myeloma
$\gamma$ -5-3-3-3	"	588/500		Ov.AC
$\gamma$ -5-3-3-4	"	665/577		Liver hist.sarcoma
$\gamma$ -5-3-6-2	"	683/595	Sp.vascular growth/Kid.glomer.cap.hyalin.dep.	
$\gamma$ -5-3-3-5	"	693/605		Lymphoma ?
$\gamma$ -5-3-5-3	"	742/654	Liv.lym.PMN inflt./Pan.lym.inflt.	
$\gamma$ -5-3-4-1	"	746/658		
$\gamma$ -5-3-4-2	"	763/675		
$\gamma$ -5-3-1-2	"	770/682	Kid.gl.hyaliniz. & urinary cast/Alveolar eos.crystal.	
$\gamma$ -5-3-1-3	"	782/694		Hist.sarcoma
$\gamma$ -5-3-2-4	"	784/696	Kid.glom.hyal./Lg.alv.eos.deposit.	
$\gamma$ -5-3-1-4	"	808/720	Liv.necrosis/Kid.glomer.hyaliniz.	PAC
$\gamma$ -5-3-4-3	"	809/721	Liv.artery hyalin./Kid.glom.hyal./Lg.alv.eos.cryst.	
$\gamma$ -5-3-6-3	"	814/726		localized Lymphoma ?
$\gamma$ -5-3-2-5	"	829/741	Kid.glom.hyalin./Lg.alveolar eos.deposits	Histiocytic sarcoma
$\gamma$ -5-3-1-5	"	857/769	Pan.lym.inflt./Lg.alv.eos.depos./Thyroid hyperplasia	
$\gamma$ -5-3-6-4	"	858/770	Kid.glom.hyalin./Lung alv.eos.crystall.	
$\gamma$ -5-3-6-5	"	872/784	Pan.islet hypertrophy/Liv.fatty deg./Alv.eos.depos.	
$\gamma$ -5-3-4-4	"	876/788	Liv.fatty deg./Pan.lym.inflt./Lg.alv.wall lym.inflt.	
$\gamma$ -5-3-4-5	"	882/794	Lg. alveolar eosinophilic crystalline, perivasc.lym.	
$\gamma$ -5-3-5-4	"	886/798		
$\gamma$ -5-3-5-5	"	900/812	Liv.deg., necrosis/Pan. islet hypertrophy	meta.Carcinoma

### Group $\gamma$ -6 (BC3)

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -6-Ct-2-1	0	685/(598)		Myeloid leukemia
$\gamma$ -6-Ct-1-1	"	772/(685)	Myocardial edema	Lymphoma
$\gamma$ -6-Ct-1-2	"	839/(752)	Liv.fatty degeneration	Lymphoma
$\gamma$ -6-Ct-1-3	"	856/(769)	Liv.fatty deg./Fatty necrosis	meta.Mam.SCC
$\gamma$ -6-Ct-1-4	"	860/(773)		
$\gamma$ -6-Ct-2-2	"	875/(788)	Liv.fatty deg./Kid.lym.inflt./Lg.lym.inflt.	
$\gamma$ -6-Ct-1-5	"	896/(809)	Liv.nod.hyperplasia, hypertrophy/Pan.islet hyperplasia	Lymphoma
$\gamma$ -6-Ct-2-3	"	944/(857)		Lymphoma ?
$\gamma$ -6-Ct-2-4	"	1028/(941)		Mam.adenocarcinoma
$\gamma$ -6-Ct-1-6	"	1070/(983)		Lymphoma
$\gamma$ -6-Ct-2-5	"	1077/(990)		SCFS/PAD
$\gamma$ -6-Ct-2-6	"	1210/(1123)	Kid.glom.hyal. & Ca/Myocard.fat/Lg.hem. & eos.crst.	Lymphoma/SCFS
$\gamma$ -6-1-1-1	1	527/440		Lymphoma
$\gamma$ -6-1-4-1	"	581/494	Liv.fatty deg.	Lym.leukemia
$\gamma$ -6-1-4-2	"	671/584		SC fibrosarcoma
$\gamma$ -6-1-3-1	"	684/597		
$\gamma$ -6-1-3-2	"	713/626		
$\gamma$ -6-1-4-3	"	715/628	Fatty liver/Pan.interstit.lym.inflt.	
$\gamma$ -6-1-2-1	"	741/654		
$\gamma$ -6-1-3-3	"	741/654		Lymphoma ?
$\gamma$ -6-1-5-1	"	741/654	Liv.fatty deg. & necrosis/Myocardial calcification	SCT
$\gamma$ -6-1-4-4	"	759/672	Liv.hypertrophy	SC fibrosarcoma
$\gamma$ -6-1-5-2	"	762/675	Liv.fatty degeneration	Pulmonary adenoma
$\gamma$ -6-1-1-2	"	770/683	Liv.necros.fat.deg./Kid,infarct/Pancreatitis/Myocaditis	meta.Ovary tumor
$\gamma$ -6-1-1-3	"	771/684	Pan.int.lym.inflt. & islet hypertrophy/Kid.scar	
$\gamma$ -6-1-2-2	"	776/689		Lymphoma?/PAD
$\gamma$ -6-1-5-3	"	783/696	Liv.fatty degeneration	
$\gamma$ -6-1-2-3	"	808/721		Myeloid leukemia
$\gamma$ -6-1-1-4	"	820/733	Kid.pelvis int.lym.inflt.	meta.SCFS
$\gamma$ -6-1-1-5	"	866/779	Kid.glom.hyal., Bowman's fibr.thicken., lym.inflt.	
$\gamma$ -6-1-5-4	"	870/783	Kid.Ca deposition	Lymphoma
$\gamma$ -6-1-6-1	"	870/783		Lymphoma?
$\gamma$ -6-1-3-4	"	902/815	Pan.islet & int.lym.inflt.	SC fibrosarcoma
$\gamma$ -6-1-3-5	"	909/822	Liv.hyp.fat.vac.deg./Kid.glom.hyal.mes.swell.	OvT/SCFS/MAC
$\gamma$ -6-1-6-2	"	925/838	Liv.nod.hyperplasia/Sp.hemat./Pan.islet hypertrophy	meta.SCFS
$\gamma$ -6-1-6-3	"	931/844		Lymphoma/OvT
$\gamma$ -6-1-6-4	"	931/844	Liv.nod.hyperplasia & hypertrophy/Sp. foll.SSE	OvT
$\gamma$ -6-1-5-5	"	938/851	Liv.fatty deg. & MNC & nod.hyperplasia	
$\gamma$ -6-1-6-5	"	954/867	Liv.necrosis & hemorrhage	Lym./HCC/OvT ?
$\gamma$ -6-1-4-5	"	965/878		OvT
$\gamma$ -6-1-2-4	"	993/906		Lymphoma ?
$\gamma$ -6-1-2-5	"	1086/999	Liv.hypertrop./Pan.islet hyp.MNC/Kid.glom.hyal.	OvT

**Group  $\gamma$ -6 (BC3; Cont'd)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -6-2-5-1	2	281/194		Lymphoma
$\gamma$ -6-2-1-1	"	321/234		
$\gamma$ -6-2-3-1	"	380/293	Fatty liver	Lymphoma
$\gamma$ -6-2-4-1	"	512/425		Thymic lymphoma
$\gamma$ -6-2-6-1	"	686/599	Liv.fatty droplet/Pan.islet atrophy/Spinal demyelin.	Myeloid leukemia/PAD
$\gamma$ -6-2-4-2	"	694/607	Pan.islet & interstitial inflammation	
$\gamma$ -6-2-6-2	"	702/615	BM fibrosis & trabecular bone proliferation	Pancreatic carcinoma
$\gamma$ -6-2-5-2	"	722/635		Lymphoma
$\gamma$ -6-2-4-3	"	728/641		meta.SC fibrosarcoma
$\gamma$ -6-2-1-2	"	734/647		meta.HGT
$\gamma$ -6-2-4-4	"	734/647		HCC
$\gamma$ -6-2-6-3	"	741/654	Liv.fatty deg. & necrosis/Lg.embolism	HGCa
$\gamma$ -6-2-2-1	"	748/661		PAC?
$\gamma$ -6-2-3-2	"	751/664		Lymphoma
$\gamma$ -6-2-2-2	"	755/668		meta.Mammary Ca.
$\gamma$ -6-2-1-3	"	776/689		Abd.liposarcoma
$\gamma$ -6-2-6-4	"	787/700		Lym/End/PAC
$\gamma$ -6-2-5-3	"	797/710		OvT
$\gamma$ -6-2-3-3	"	819/732	Myocarditis/BM fibrosis	Lymphoma?
$\gamma$ -6-2-2-3	"	835/748	Liv.fatty deg./Kid.pelv.hyp./Thyr.lym.inflt.	OvT/Thyr.Ca
$\gamma$ -6-2-5-4	"	839/752		Lymphoma/OvT/LungT
$\gamma$ -6-2-3-4	"	840/753	Liv.fatty deg./Kid.MNC inflt.	
$\gamma$ -6-2-5-5	"	842/755	Liv.hypertrophy, hyperplasia	meta.Uterus tumor
$\gamma$ -6-2-1-4	"	853/766		Lymphoma?/PAC
$\gamma$ -6-2-1-5	"	877/790	Liv.myeloid cells/Kid.glom.PMN & int.MNC	SCCa/PAC
$\gamma$ -6-2-2-4	"	881/794		
$\gamma$ -6-2-6-5	"	902/815	Liv.necr.fat.deg.nod.hyp./Kid.lym.inflt.	local.Lymphoma ?
$\gamma$ -6-2-4-5	"	912/825	Liv.GM hemopoietic cells	Lymphoma ?/SCAC
$\gamma$ -6-2-3-5	"	930/843		Histiocytic sarcoma
$\gamma$ -6-2-2-5	"	1014/927		meta.HCC/PAC

**Group  $\gamma$ -6 (BC3; Cont'd)**

Animal ID	Dose (Gy)	Survival (day)	Histopathology	
			Non-Neoplastic Lesions	Neoplasms
$\gamma$ -6-3-1-1	3	301/214		
$\gamma$ -6-3-5-1	"	325/238		Ov.tumor
$\gamma$ -6-3-2-1	"	398/311	Liv.fatty deg.	Lymphoma
$\gamma$ -6-3-5-2	"	451/364		Lymphoma
$\gamma$ -6-3-4-1	"	489/402		
$\gamma$ -6-3-4-2	"	524/437	Fatty liver/Inflammation of fat tissues	
$\gamma$ -6-3-6-1	"	561/474	Liv.fatty droplet/Pancreas fat replace.	
$\gamma$ -6-3-3-1	"	563/476	Liv.focal necrosis/Lg.atelectasis	OS
$\gamma$ -6-3-5-3	"	574/487		met.OS
$\gamma$ -6-3-6-2	"	608/521	Liv.fatty deg.&necrosis/Kid.glom.swell.lym.inflt.	
$\gamma$ -6-3-1-2	"	629/542		HCC
$\gamma$ -6-3-3-2	"	660/573	BM fibrosis & trabecular proliferation	Ov.tumor
$\gamma$ -6-3-6-3	"	661/574		Lymphoma
$\gamma$ -6-3-4-3	"	664/577		Lymphoma
$\gamma$ -6-3-5-4	"	665/578	Pan.int.lym.inflt.	SCT/OvT
$\gamma$ -6-3-5-5	"	668/581		Liposarcoma
$\gamma$ -6-3-1-3	"	671/584		
$\gamma$ -6-3-4-4	"	673/586		meta.Harderian gl.AC
$\gamma$ -6-3-3-3	"	693/606		Lymphoma/OvCa/PAC
$\gamma$ -6-3-3-4	"	720/633	Liv.fatty degeneration	
$\gamma$ -6-3-2-2	"	745/658		Lymphoma
$\gamma$ -6-3-6-4	"	745/658	Liv.fatty deg./Sp.vasculariz./Pan.lym.inflt.	PAC/HCAD
$\gamma$ -6-3-3-5	"	755/668	BM.trabecular bone growth	meta.Ovary tumor
$\gamma$ -6-3-4-5	"	762/675	Liv.hypertropgy & hyperplasia/BM fibrosis	Mam.adenocarcinoma
$\gamma$ -6-3-2-3	"	765/678		meta.HGCa
$\gamma$ -6-3-1-4	"	772/685	Liv.necrosi&fatty deg./Kid.glom.hyal./Heart edema	Lym./PAD/Hem.T.
$\gamma$ -6-3-1-5	"	793/705	Pan.islet hypertrophy	meta.HCC
$\gamma$ -6-3-6-5	"	828/741	Pan.islet hypertrophy/Kid.cast & Bowmans thick.	HCC/OvT
$\gamma$ -6-3-2-4	"	832/745		Lymphoma
$\gamma$ -6-3-2-5	"	959/872	Liv.nod.hyp.MNC/Kid.lym./Myocard.necr.lym.	MAC

## 4. Lists for Histological Specimens of Neoplasms from Individual Animals

### 4.1 Lung Tumors from Rats

The following tables list up the selected specimens prepared for histopathological and immunohistochemical examinations of rat primary lung tumors obtained from both the experiments for inhalation exposures to  $^{239}\text{PuO}_2$  aerosols (Groups A to B') and X-irradiation (Groups X-1 to X-15). These include the paraffin-embedded blocks, histological sections on glass slides stained with hematoxylin-eosin and others for immunohistochemistry, MO disc files of microscopic pictures, established cell lines and DNA samples, respectively together with the information of individual animal case of lung tumors.

#### 4.1.1 Paraffin-Blocks

The selected paraffin-blocks of primary lung tumors from individual animals are put in a sealed plastic bag, stored in a bundle of the groups in the box. The following tables list the information of case number, survival period, initial lung deposition and lung dose for  $^{239}\text{PuO}_2$ -exposures or total dose for X-irradiation, and histopathological diagnosis of lung tumors of the individual animals as well as the number (#) of the container box.

**Selected Paraffin-Blocks from the Groups of Pu-Exposed Rats**

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathological Diagnosis Primary Lung Tumors	Box #
Ct G3	0	777	0	Squamous cell carcinoma	1
A-8	2433	557	15.4	Adenocarcinoma	1
A-9	2328	562	14.8	Squamous cell carcinoma	
A-7	3065	630	20.3	Adenosquamous carcinoma	
C-1-1-1	905	494	5.19	Adenoma	1
C-2-2-1	817	514	4.77	Squamous cell carcinoma	
C-2-2-2	796	529	4.69	Adenoma	
C-1-1-2	817	568	4.96	Adenocarcinoma	
C-1-2-1	1003	597	6.19	Squamous cell carcinoma	
C-2-2-3	774	613	4.84	Adenocarcinoma	
C-1-1-3	719	742	4.84	Adenosquamous carcinoma	
C-1-1-4	687	761	4.67	Adenosquamous carcinoma	
C-1-2-2	970	673	6.29	Adenocarcinoma	
C-1-2-3	905	679	5.89	Adenocarcinoma	
C-1-2-4	828	706	5.47	Adenoma	
C-2-1-1	98	771	0.67	Adenoma	
C-2-2-4	730	643	4.65	Adenocarcinoma	
C-2-2-5	512	736	3.44	Adenoma	

**Selected Paraffin-Blocks from the Groups of Pu-Exposed Rats (Cont'd)**

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathological Diagnosis Primary Lung Tumors	Box #
D-1-1-1	1208	250	5.53	Adenocarcinoma	1
D-2-1-1	1273	372	6.68	Adenosquamous carcinoma	
D-2-1-2	1182	450	6.66	Adenocarcinoma	
D-1-1-2	1155	513	6.85	Adenosquamous carcinoma	
D-2-2-1	1227	543	7.44	Adenosquamous carcinoma	
D-2-2-2	1057	543	6.41	Adenosquamous carcinoma	
D-1-2-2	1151	565	7.08	Adenosquamous carcinoma	
D-1-2-3	1055	573	6.53	Adenosquamous carcinoma	
D-2-1-3	1111	575	6.88	Adenosquamous carcinoma	
D-2-1-4	989	576	6.12	Adenoma	
D-2-2-3	1052	580	6.53	Adenosquamous carcinoma	
D-2-2-4	961	584	5.99	Adenosquamous carcinoma	
D-1-1-4	1037	585	6.46	Adenocarcinoma	
D-1-2-4	1032	593	6.47	Adenosquamous carcinoma	
D-1-1-5	976	594	6.12	Adenocarcinoma	
D-1-2-5	985	635	6.34	Adenosquamous carcinoma	
D-2-1-5	928	656	6.04	Adenosquamous carcinoma	
D-2-2-5	626	725	4.24	Adenocarcinoma	
E-2-2-1	1883	363	9.31	Adenocarcinoma	1
E-1-2-1	1840	418	9.60	Adenocarcinoma	
E-2-1-1	1658	450	8.89	Adenosquamous carcinoma	
E-2-2-2	1519	468	8.28	Adenosquamous carcinoma	
E-1-2-2	1669	456	8.98	Adenosquamous carcinoma	
E-1-2-3	1476	475	8.08	Adenosquamous carcinoma	
E-2-1-2	1605	475	8.79	Adenosquamous carcinoma	
E-1-2-4	1241	489	6.88	Adenosquamous carcinoma	
E-1-1-2	1444	499	8.07	Adenoma	
E-2-1-3	1551	510	8.74	Adenosquamous carcinoma	
E-2-1-4	1541	520	8.75	Adenocarcinoma	
E-1-1-4	1327	544	7.67	Adenocarcinoma	
E-2-1-5	1188	609	7.19	Adenocarcinoma	
E-2-2-3	1369	577	8.10	Adenosquamous carcinoma	
E-2-2-4	867	608	5.25	Adenocarcinoma	
E-2-2-5	727	656	4.54	Adenosquamous carcinoma	
E-1-1-5	1102	656	6.87	Squamous cell carcinoma	
E-1-2-5	695	751	4.58	Adenosquamous carcinoma	
F-2-2-2	1263	466	6.50	Adenocarcinoma	2
F-2-2-3	1231	486	6.44	Adenosquamous carcinoma	
F-2-2-4	1231	495	6.50	Adenocarcinoma	
F-1-2-3	1004	527	5.43	Adenosquamous carcinoma	
F-1-1-1	1458	528	7.92	Adenosquamous carcinoma	
F-1-1-2	1307	531	7.10	Adenocarcinoma	
F-1-1-3	1274	546	7.01	Adenocarcinoma	
F-1-1-4	1263	557	7.00	Adenosquamous carcinoma	
F-2-2-5	1231	557	6.82	Adenosquamous carcinoma	
F-2-1-2	1307	487	6.84	Squamous cell carcinoma	
F-2-1-3	1231	581	6.95	Adenocarcinoma	
F-2-1-4	1123	581	6.34	Adenosquamous carcinoma	
F-1-1-5	950	595	5.42	Adenoma	
F-2-1-5	831	612	4.80	Adenosquamous carcinoma	
F-1-2-4	885	623	5.16	Adenosquamous carcinoma	
F-1-2-5	637	661	3.80	Adenocarcinoma	

**Selected Paraffin-Blocks from the Groups of Pu-Exposed Rats (Cont'd)**

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathological Diagnosis Primary Lung Tumors	Box #
G-1-1-1	1979	343	8.49	Adenocarcinoma	2
G-2-1-1	2322	392	10.5	Adenosquamous carcinoma	
G-2-1-2	1990	399	9.09	Adenosquamous carcinoma	
G-2-2-1	2204	428	10.4	Adenocarcinoma	
G-1-1-3	1840	444	8.80	Adenosquamous carcinoma	
G-1-2-5	2279	446	10.9	Adenocarcinoma	
G-2-2-2	1990	449	9.57	Adenocarcinoma	
G-2-2-3	1872	450	9.00	Adenocarcinoma	
G-1-1-4	1819	469	8.91	Squamous cell carcinoma	
G-2-2-4	1872	477	9.22	Adenocarcinoma	
G-2-1-3	1862	482	9.21	Adenocarcinoma	
G-2-2-5	1658	512	8.42	Adenocarcinoma	
G-2-1-4	1637	526	8.42	Adenosquamous carcinoma	
G-1-1-5	1498	526	7.71	Adenosquamous carcinoma	
G-2-1-5	963	600	5.22	Squamous cell carcinoma	
H-2-1-1	972	465	4.83	Adenosquamous carcinoma	2
H-1-2-1	918	541	4.87	Adenoma	
H-1-2-2	831	552	4.45	Adenoma	
H-1-1-1	1058	572	5.75	Adenosquamous carcinoma	
H-2-2-1	939	586	5.16	Adenocarcinoma	
H-2-2-2	929	586	5.11	Squamous cell carcinoma	
H-1-1-2	896	618	5.05	Adenoma	
H-1-2-3	810	627	4.58	Adenosquamous carcinoma	
H-2-1-2	939	627	5.31	Adenosquamous carcinoma	
H-1-2-4	756	628	4.29	Adenocarcinoma	
H-1-1-3	885	657	5.11	Adenosquamous carcinoma	
H-2-1-3	885	671	5.16	Adenosquamous carcinoma	
H-1-1-4	756	680	4.44	Adenocarcinoma	
H-2-1-4	821	694	4.87	Adenocarcinoma	
H-1-2-5	756	705	4.51	Adenosquamous carcinoma	
H-2-2-4	885	725	5.35	Adenosquamous carcinoma	
H-1-1-5	713	758	4.40	Squamous cell carcinoma	
H-2-2-5	756	766	4.68	Adenosquamous carcinoma	
H-2-1-5	702	776	4.37	Adenosquamous carcinoma	

**Selected Paraffin-Blocks from the Groups of Pu-Exposed Rats (Cont'd)**

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathological Diagnosis Primary Lung Tumors	Box #
I-2-4-1	1037	475	5.10	Adenocarcinoma	2 & 3
I-1-2-1	1080	517	5.51	Adenosquamous carcinoma	
I-1-4-1	972	519	4.98	Adenocarcinoma	
I-2-3-1	993	570	5.30	Adenosquamous carcinoma	
I-1-1-1	983	581	5.33	Squamous cell carcinoma	
I-2-4-2	918	581	4.98	Adenocarcinoma	
I-1-4-2	853	590	4.66	Adenoma	
I-2-1-3	734	636	4.15	Squamous cell carcinoma	
I-1-1-3	821	662	4.72	Squamous cell carcinoma	
I-1-2-2	983	671	5.69	Adenocarcinoma	
I-1-3-1	993	671	5.75	Adenocarcinoma	
I-2-2-2	885	672	5.12	Squamous cell carcinoma	
I-2-2-3	821	681	4.78	Adenocarcinoma	
I-1-2-3	983	700	5.80	Adenocarcinoma	
I-2-1-4	680	704	4.02	Adenoma	
I-1-4-3	842	708	5.00	Adenomatous metaplasia	
I-2-4-3	799	724	4.79	Squamous cell carcinoma	
I-2-1-5	605	731	3.64	Adenocarcinoma	
I-1-2-4	907	732	5.45	Adenocarcinoma	
I-1-3-2	972	763	5.97	Adenocarcinoma	
I-1-2-5	756	771	4.65	Adenocarcinoma	
I-1-1-4	615	783	3.82	Adenocarcinoma	
I-1-3-3	907	785	5.63	Adenocarcinoma	
I-1-4-5	767	787	4.76	Adenocarcinoma	
I-2-2-4	799	791	4.97	Adenosquamous carcinoma	
I-2-4-4	734	803	4.61	Adenoma	
I-1-3-4	831	805	5.22	Adenosquamous carcinoma	
I-1-3-5	659	808	4.15	Adenosquamous carcinoma	
I-2-3-3	983	816	6.21	Adenocarcinoma	
I-2-3-4	691	816	4.36	Adenosquamous carcinoma	
I-2-2-5	745	856	4.80	Adenoma	
I-2-3-5	104	1006	0.72	Adenoma	
K-1-3-1	262	558	1.63	Adenocarcinoma	3
K-1-4-1	278	570	1.74	Adenoma	
K-1-4-3	205	637	1.34	Adenoma	
K-1-1-2	262	703	1.78	Adenoma	
K-1-1-3	259	722	1.78	Adenocarcinoma	
K-2-4-2	180	722	1.23	Adenoma	
K-1-4-4	167	727	1.15	Adenocarcinoma	
K-2-2-3	143	801	1.02	Adenoma	
K-2-2-4	119	818	0.86	Adenoma	
K-1-3-2	259	839	1.89	Adenoma	
K-1-2-2	232	874	1.72	Adenoma	
K-1-3-4	132	889	0.98	Adenoma	
K-2-4-4	126	894	0.94	Adenoma	
K-2-2-5	75	946	0.57	Adenocarcinoma	
K-1-1-4	238	951	1.82	Adenocarcinoma	
K-2-4-5	35	958	0.27	Adenoma	
K-1-2-4	201	974	1.55	Adenocarcinoma	
K-2-1-5	64	976	0.49	Adenocarcinoma	
K-1-1-5	237	1010	1.85	Adenocarcinoma	
K-1-2-5	195	1044	1.52	Adenocarcinoma	
K-1-3-5	64	1069	0.50	Adenoma	
M-3-1	110	676	0.76	Adenoma	3
M-2-2	114	821	0.85	Adenocarcinoma	
M-4-3	85	897	0.65	Adenoma	
M-4-5	57	1011	0.46	Adenoma	



**Selected Paraffin-Blocks from the Groups of Pu-Exposed Rats (Cont'd)**

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathological Diagnosis Primary Lung Tumors	Box #
N-4-1	240	452	1.38	Adenoma	3
N-4-2	219	532	1.34	Adenocarcinoma	
N-5-1	288	616	1.86	Adenoma	
N-4-3	210	636	1.37	Adenosquamous carcinoma	
N-3-1	255	686	1.72	Adenocarcinoma	
N-2-1	202	725	1.39	Adenoma	
N-2-2	170	730	1.17	Adenosquamous carcinoma	
N-6-2	264	755	1.84	Adenocarcinoma	
N-5-3	195	756	1.36	Adenocarcinoma	
N-3-2	241	761	1.69	Adenoma	
N-3-3	215	764	1.51	Adenocarcinoma	
N-6-3	247	791	1.76	Adenoma	
N-2-4	160	809	1.15	Adenocarcinoma	
N-6-4	224	809	1.61	Adenosquamous carcinoma	
N-3-4	213	870	1.57	Adenosquamous carcinoma	
N-7-2	251	882	1.86	Adenocarcinoma	
N-7-3	249	891	1.85	Adenocarcinoma	
N-6-5	175	903	1.31	Adenocarcinoma	
N-7-4	214	919	1.61	Adenocarcinoma	
N-3-5	190	947	1.43	Adenocarcinoma	
N-1-4	148	970	1.14	Adenocarcinoma	
N-1-5	110	1002	0.86	Adenocarcinoma	
N-5-5	122	1002	0.95	Adenoma	
P-1-3-1	694	328	3.65	Adenocarcinoma	3 & 4
P-1-3-3	507	618	3.34	Adenocarcinoma	
P-1-1-3	462	680	3.15	Adenosquamous carcinoma	
P-1-4-1	546	683	3.74	Adenosquamous carcinoma	
P-1-4-2	527	695	3.63	Adenocarcinoma	
P-1-4-3	442	701	3.05	Adenocarcinoma	
P-1-3-4	483	701	3.34	Adenocarcinoma	
P-1-3-5	252	731	1.77	Adenocarcinoma	
P-1-2-3	452	746	3.20	Adenocarcinoma	
P-1-1-4	361	757	2.56	Adenocarcinoma	
P-1-2-4	401	768	2.87	Adenocarcinoma	
P-1-1-5	324	843	2.40	Adenocarcinoma	
P-1-2-5	399	935	3.07	Adenocarcinoma	
Q-1-2-1	461	424	2.45	Adenoma	4
Q-1-4-1	538	523	3.11	Adenocarcinoma	
Q-1-4-2	448	533	2.61	Adenocarcinoma	
Q-1-4-3	404	561	2.40	Adenocarcinoma	
Q-1-3-2	483	591	2.93	Adenocarcinoma	
Q-1-3-3	405	622	2.50	Adenosquamous carcinoma	
Q-1-3-4	394	650	2.48	Squamous cell carcinoma	
Q-1-2-3	427	682	2.75	Adenocarcinoma	
Q-1-1-2	415	702	2.69	Adenoma	
Q-1-1-3	412	715	2.70	Adenocarcinoma	
Q-1-2-4	382	741	2.57	Adenosquamous carcinoma	
Q-1-4-4	368	761	2.47	Adenoma	
Q-1-3-5	357	783	2.43	Adenocarcinoma	
Q-1-1-4	411	809	2.83	Adenocarcinoma	
Q-1-1-5	350	892	2.50	Adenosquamous carcinoma	

**Selected Paraffin-Blocks from the Groups of Pu-Exposed Rats (Cont'd)**

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathological Diagnosis Primary Lung Tumors	Box #
R-1-2-2	312	535	1.95	Adenoma	4
R-1-1-2	263	689	1.81	Adenocarcinoma	
R-1-3-3	312	700	2.15	Adenocarcinoma	
R-1-2-4	294	783	2.12	Adenoma	
R-1-4-2	321	824	2.36	Adenocarcinoma	
R-1-3-5	271	889	2.05	Adenocarcinoma	
R-1-1-4	240	913	1.83	Adenocarcinoma	
R-1-4-3	315	970	2.46	Adenocarcinoma	
R-1-2-5	262	993	2.07	Adenosquamous carcinoma	
R-1-1-5	182	1010	1.44	Adenocarcinoma	
S-1-3-1	605	320	3.22	Adenocarcinoma	4
S-1-1-1	491	436	2.90	Squamous cell carcinoma	
S-1-1-2	395	497	2.44	Adenocarcinoma	
S-2-1-1	216	605	1.44	Adenocarcinoma	
S-1-3-2	450	665	3.10	Adenosquamous carcinoma	
S-1-3-3	437	692	3.06	Adenocarcinoma	
S-1-4-3	433	714	3.07	Squamous cell carcinoma	
S-1-4-4	379	717	2.69	Adenocarcinoma	
S-1-4-5	358	728	2.56	Adenosquamous carcinoma	
S-1-1-3	395	748	2.85	Adenocarcinoma	
S-1-3-4	421	779	3.08	Adenocarcinoma	
S-1-2-4	344	783	2.52	Adenocarcinoma	
S-1-3-5	354	804	2.62	Adenocarcinoma	
S-1-1-4	382	815	2.84	Adenocarcinoma	
S-1-2-5	332	835	2.49	Adenocarcinoma	
S-2-3-2	167	845	1.26	Adenocarcinoma	
S-2-3-3	141	889	1.08	Adenocarcinoma	
S-2-1-4	147	895	1.13	Adenocarcinoma	
S-1-1-5	335	904	2.59	Adenocarcinoma	
S-2-1-5	110	920	0.86	Adenocarcinoma	
S-2-3-5	120	1040	0.96	Adenocarcinoma	
S-2-4-5	100	1040	0.80	Adenocarcinoma	
T-1-3-4	262	747	1.80	Squamous cell carcinoma	4
T-1-3-5	235	761	1.62	Adenoma	
T-1-2-1	310	801	2.18	Adenocarcinoma	
T-1-1-4	289	824	2.06	Adenocarcinoma	
T-1-2-3	290	835	2.08	Adenocarcinoma	
T-1-2-4	256	841	1.84	Adenoma	
T-1-1-5	258	874	1.88	Adenocarcinoma	
V-3-4-2	257	518	1.56	Adenocarcinoma	4
V-3-1-3	283	665	1.88	Adenocarcinoma	
V-3-1-4	280	746	1.95	Adenocarcinoma	
V-3-4-4	250	752	1.74	Adenocarcinoma	
V-3-3-1	280	763	1.97	Adenocarcinoma	
V-3-3-2	275	767	1.93	Adenocarcinoma	
V-3-3-3	275	807	1.97	Squamous cell carcinoma	
V-3-3-4	238	810	1.71	Adenocarcinoma	
V-3-4-5	237	892	1.77	Adenocarcinoma	
V-3-2-4	232	925	1.75	Adenocarcinoma	
V-3-1-5	243	998	1.89	Adenocarcinoma	

**Selected Paraffin-Blocks from the Groups of Pu-Exposed Rats (Cont'd)**

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathological Diagnosis Primary Lung Tumors	Box #
W-1-4-2	444	490	2.63	Adenocarcinoma	5
W-1-2-2	446	559	2.78	Adenocarcinoma	
W-2-2-1	60	567	0.37	Adenoma	
W-1-2-3	425	634	2.78	Adenoma	
W-1-2-4	423	634	2.77	Adenocarcinoma	
W-1-1-3	388	674	2.60	Adenocarcinoma	
W-1-4-4	377	740	2.61	Adenocarcinoma	
W-1-4-5	342	750	2.38	Adenocarcinoma	
W-1-3-3	407	770	2.87	Adenocarcinoma	
W-1-3-4	397	778	2.81	Adenocarcinoma	
W-1-1-4	362	828	2.62	Adenosquamous carcinoma	
W-1-1-5	347	839	2.53	Adenocarcinoma	
W-2-2-4	51	873	0.38	Squamous cell carcinoma	
W-2-4-5	44	990	0.34	Adenoma	
W-2-3-5	56	1034	0.43	Adenoma	
W-2-1-4	53	943	0.40	Adenocarcinoma	
W-2-1-5	50	1077	0.39	Adenoma	
W-1-3-5	363	829	2.63	Adenocarcinoma	
W-2-3-3	60	966	0.46	Adenoma	
X-3-1-4	26	826	0.19	Adenoma	5
X-3-3-4	36	857	0.27	Adenocarcinoma	
Y-2-3-1	371	486	2.28	Adenocarcinoma	5
Y-1-3-1	447	611	2.99	Squamous cell carcinoma	
Y-1-3-2	404	649	2.76	Squamous cell carcinoma	
Y-1-4-1	530	710	3.75	Adenoma	
Y-2-1-1	294	728	2.10	Adenocarcinoma	
Y-2-4-3	320	751	2.31	Adenoma	
Y-1-1-2	403	766	2.93	Adenocarcinoma	
Y-2-2-3	272	772	1.98	Adenocarcinoma	
Y-2-1-2	284	780	2.08	Adenocarcinoma	
Y-2-3-2	271	780	1.98	Adenocarcinoma	
Y-1-4-2	367	783	2.69	Adenosquamous carcinoma	
Y-1-1-4	388	788	2.85	Adenocarcinoma	
Y-1-2-1	410	792	3.02	Adenocarcinoma	
Y-1-1-5	313	795	2.31	Adenocarcinoma	
Y-1-3-4	382	799	2.82	Adenocarcinoma	
Y-2-1-3	283	804	2.10	Adenocarcinoma	
Y-2-4-4	264	808	1.96	Adenocarcinoma	
Y-1-3-5	374	819	2.79	Adenocarcinoma	
Y-1-2-2	380	839	2.86	Squamous cell carcinoma	
Y-1-2-3	371	846	2.80	Adenocarcinoma	
Y-1-4-3	344	855	2.61	Adenocarcinoma	
Y-1-4-4	341	887	2.62	Adenocarcinoma	
Y-2-1-4	258	912	2.00	Adenocarcinoma	
Y-2-3-3	263	928	2.05	Adenocarcinoma	
Y-2-1-5	239	932	1.87	Adenocarcinoma	
Y-2-3-4	226	934	1.77	Adenocarcinoma	
Y-2-4-5	234	973	1.86	Squamous cell carcinoma	
Y-2-3-5	224	974	1.78	Adenocarcinoma	
Y-2-2-5	259	1001	2.08	Adenocarcinoma	
Y-1-2-4	322	1022	2.58	Adenocarcinoma	

**Selected Paraffin-Blocks from the Groups of Pu-Exposed Rats (Cont'd)**

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathological Diagnosis Primary Lung Tumors	Box #
Z-1-3-3	185	435	1.03	Adenocarcinoma	5
Z-3-2-1	498	668	3.27	Adenocarcinoma	
Z-3-2-2	447	730	3.04	Adenocarcinoma	
Z-3-2-3	395	730	2.68	Squamous cell carcinoma	
Z-3-2-4	412	730	2.80	Adenocarcinoma	
Z-3-2-5	492	730	3.34	Adenocarcinoma	
Z-3-3-1	472	460	2.68	Adenoma	
Z-3-3-2	418	460	2.38	Adenoma	
A'-1-4-1	434	358	2.25	Adenoma	5
A'-1-4-3	410	658	2.68	Adenosquamous carcinoma	
A'-1-4-5	375	793	2.63	Adenocarcinoma	
A'-2-1-1	445	413	2.43	Adenocarcinoma	
A'-2-1-4	419	730	2.85	Adenocarcinoma	
A'-2-1-5	380	730	2.58	Adenocarcinoma	
A'-2-2-4	356	795	2.50	Adenosquamous carcinoma	
B'-3-1-1	44	458	0.23	Adenoma	5
B'-1-1-3	28	838	0.19	Adenoma	
B'-1-4-2	28	882	0.19	Adenoma	
B'-1-4-3	19	898	0.13	Adenoma	
B'-1-1-4	18	936	0.12	Adenoma	
B'-1-1-5	6	989	0.04	Adenoma	
C'-1-3-1	46	616	0.27	Adenoma	5
C'-3-2-2	40	668	0.25	Adenoma	
C'-3-2-3	39	693	0.24	Adenocarcinoma	
C'-3-1-3	42	821	0.28	Adenocarcinoma	
C'-2-3-4	23	924	0.16	Adenoma	
C'-1-1-3	19	943	0.13	Adenoma	

**Selected Paraffin-Blocks from the Groups of Whole-Body X-Irradiated Rats**

Animal ID	Total Dose (Gy)	Survival/Post-X (day)	Histopathological Diagnosis Primary Lung Tumors	Box #
X-1-4-3	1.0	771/679	Adenoma	6
X-1-10-5	5.0	764/644	Adenocarcinoma	
X-3-2-3	0.5	592/504	Adenocarcinoma	6
X-3-8-2	2.0	727/628	Adenoma	
X-3-10-2	3.0	715/609	Adenoma	
X-3-10-5	3.0	883/777	Adenocarcinoma	
X-4-6-2	1.0	626/530	Adenocarcinoma	6
X-4-10-4	2.0	715/612	Adenoma	
X-4-12-4	3.0	780/670	Adenosquamous carcinoma	
X-4-13-4	3.0	624/514	Adenoma	
X-4-14-3	3.0	827/717	Adenocarcinoma	
X-5-9-5	5.0	896/780	Adenocarcinoma	6
X-6-3-4	10.0	789/630	Adenocarcinoma	
X-6-4-5	10.0	729/570	Adenoma	
X-6-9-5	10.0	654/495	Adenoma	
X-6-10-1	10.0	568/409	Adenocarcinoma	

### Selected Paraffin-Blocks from the Groups of Thoracic X-Irradiated Rats

Animal ID	Total Dose (Gy)	Survival/Post-X (day)	Histopathological Diagnosis Primary Lung Tumors	Box #
X-8-1-2	3.0	904/718	Adenocarcinoma	6
X-8-1-3	3.0	912/726	Adenocarcinoma	
X-8-3-2	3.0	834/648	meta.Osteosarcoma	
X-8-6-4	5.0	826/640	Adenoma/squamous cell ca.	
X-8-7-2	5.0	569/383	Undifferentiated carcinoma	
X-8-8-2	5.0	825/639	Squamous cell carcinoma	
X-8-4-4	3.0	896/710	Adenoma	
X-8-6-2	5.0	669/483	Metaplasia	
X-8-6-3	5.0	677/491	Adenoma	
X-8-7-4	5.0	1020/834	Adenocarcinoma	
X-8-8-3	5.0	972/786	Adenoma	
X-9-1-3	3.0	898/746	Adenocarcinoma	6
X-9-2-3	3.0	790/638	Adenoma	
X-9-5-4	5.0	745/593	Adenoma	
X-9-6-1	5.0	830/678	Adenocarcinoma	
X-9-7-5	5.0	908/756	Adenocarcinoma	
X-10-7-2	10.0	676/570	Squamous cell carcinoma	6
X-10-9-5	10.0	659/553	Adenocarcinoma	
X-10-6-1	5.0	517/411	Squamous cell carcinoma	
X-10-6-2	5.0	714/608	Adenocarcinoma	
X-10-8-3	10.0	566/460	Adenoma	
X-10-1-1	5.0	623/517	Adenoma	
X-10-4-2	3.0	731/625	Adenoma	
X-10-7-4	10.0	762/656	Adenocarcinoma	
X-10-4-5	3.0	1014/908	Adenocarcinoma	
X-11-7-2	10.0	699/599	Adenocarcinoma	6
X-11-9-5	10.0	742/642	Adenoma	
X-11-7-5	10.0	744/644	Adenocarcinoma	
X-11-8-5	10.0	784/684	Adenoma	
X-11-6-5	10.0	857/757	Adenoma	
X-11-2-5	3.0	982/882	Adenocarcinoma	
X-12-8-3	10.0	490/382	Adenoma	6
X-12-8-4	10.0	612/504	Adenoma	
X-12-9-5	10.0	689/581	Adenoma	
X-12-6-4	5.0	787/679	Adenocarcinoma	
X-12-2-3	3.0	898/790	Adenoma	
X-12-3-5	3.0	955/847	Adenocarcinoma	
X-13-8-1	10.0	583/485	Adenoma	6
X-13-4-1	5.0	426/328	Squamous cell carcinoma	
X-13-9-3	10.0	604/506	Adenocarcinoma	
X-13-4-2	5.0	682/584	Adenocarcinoma	
X-13-8-4	10.0	720/622	Adenocarcinoma	
X-13-6-5	5.0	741/643	Adenoma	
X-13-7-5	10.0	755/657	Adenocarcinoma	
X-13-3-1	3.0	763/665	Adenoma	
X-13-1-3	3.0	794/696	Squamous cell carcinoma	
X-13-8-5	10.0	828/730	Adenoma	
X-13-4-4	5.0	883/785	Adenoma	
X-14-Ct3-3	0	597/496	meta.Carcinoma	6
X-14-12-3	1.0	528/427	Adenoma	
X-14-Ct5-5	0	503/402	meta.Carcinoma	
X-14-7-2	1.0	731/630	Adenoma	

#### 4.1.2 Histological Sections

The selected histological section slides of primary lung tumors from individual animals are put in a plastic box as indicated by the number. The following tables list the information of case number, survival period, initial lung deposition and lung dose for  $^{239}\text{PuO}_2$ -exposures or total dose for X-irradiation, and histopathological diagnosis of lung tumors of the individual animals as well as the number (#) of the slide box.

**Selected Section Slides from the Groups of Pu-Exposed Rats**

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathological Diagnosis Primary Lung Tumors	Box #
Ct G3	0	777	0	Squamous cell carcinoma	PuIH 1
A-9	2328	562	14.8	Squamous cell carcinoma	
C-2-2-1	817	514	4.77	Squamous cell carcinoma	
C-1-1-2	817	568	4.96	Adenocarcinoma	
C-1-2-2	970	673	6.29	Adenocarcinoma	
C-1-1-4	687	761	4.67	Adenosquamous carcinoma	
D-1-1-1	1208	250	5.53	Adenocarcinoma	
D-2-1-2	1182	450	6.66	Adenocarcinoma	
D-1-1-2	1155	513	6.85	Adenosquamous carcinoma	
D-2-2-1	1227	543	7.44	Adenocarcinoma	
D-2-2-3	1052	580	6.53	Adenosquamous carcinoma	
D-2-2-4	961	584	5.99	Adenosquamous carcinoma	
E-1-2-2	1669	456	8.98	Adenosquamous carcinoma	
E-1-2-3	1476	475	8.08	Adenosquamous carcinoma	
E-1-2-4	1241	489	6.88	Adenosquamous carcinoma	
E-2-1-5	1188	609	7.19	Adenocarcinoma	
E-1-1-5	1102	656	6.87	Squamous cell carcinoma	PuIH 2
F-2-1-2	1307	487	6.84	Squamous cell carcinoma	
G-1-1-3	1840	444	8.80	Adenosquamous carcinoma	
G-2-2-3	1872	450	9.00	Adenocarcinoma	
G-1-1-4	1819	469	8.91	Squamous cell carcinoma	
G-2-1-4	1637	526	8.42	Adenosquamous carcinoma	
G-1-1-5	1498	526	7.71	Adenosquamous carcinoma	
G-2-1-5	963	600	5.22	Squamous cell carcinoma	
H-2-1-1	972	465	4.83	Adenosquamous carcinoma	
H-1-1-1	1058	572	5.75	Adenosquamous carcinoma	
H-2-2-2	929	586	5.11	Squamous cell carcinoma	
H-1-1-3	885	657	5.11	Adenosquamous carcinoma	
H-2-1-4	821	694	4.87	Adenocarcinoma	
H-1-2-5	756	705	4.51	Adenosquamous carcinoma	
H-2-2-4	885	725	5.35	Adenosquamous carcinoma	
H-2-2-5	756	766	4.68	Adenosquamous carcinoma	
H-2-1-5	702	776	4.37	Adenosquamous carcinoma	PuIH 3
I-2-4-2	918	581	4.98	Adenocarcinoma	
I-2-1-3	734	636	4.15	Squamous cell carcinoma	
I-1-1-3	821	662	4.72	Squamous cell carcinoma	
I-2-2-2	885	672	5.12	Squamous cell carcinoma	
I-2-1-5	605	731	3.64	Adenocarcinoma	
I-1-2-4	907	732	5.45	Adenocarcinoma	
I-2-2-4	799	791	4.97	Adenosquamous carcinoma	
I-1-3-5	659	808	4.15	Adenosquamous carcinoma	
I-2-3-4	691	816	4.36	Adenosquamous carcinoma	
I-2-2-5	745	856	4.80	Adenoma	
K-1-1-2	262	703	1.78	Adenoma	
K-2-2-5	75	946	0.57	Adenocarcinoma	
K-2-1-5	64	976	0.49	Adenocarcinoma	
K-1-3-5	64	1069	0.50	Adenoma	
M-4-2	85	857	0.64	Adenoma	

**Selected Section Slides from the Groups of Pu-Exposed Rats (Cont'd)**

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathological Diagnosis Primary Lung Tumors	Box #
N-4-3	210	636	1.37	Adenosquamous carcinoma	PuIH 4
N-2-2	170	730	1.17	Adenosquamous carcinoma	
N-5-3	195	756	1.36	Adenocarcinoma	
N-3-2	241	761	1.69	Adenoma	
N-6-3	247	791	1.76	Adenoma	
N-6-4	224	809	1.61	Adenosquamous carcinoma	
N-3-4	213	870	1.57	Adenosquamous carcinoma	
N-7-3	249	891	1.85	Adenocarcinoma	
P-1-1-3	462	680	3.15	Adenosquamous carcinoma	
P-1-4-1	546	683	3.74	Adenosquamous carcinoma	
P-1-4-2	527	695	3.63	Adenocarcinoma	
P-1-4-3	442	701	3.05	Adenocarcinoma	
P-1-3-4	483	701	3.34	Adenocarcinoma	
P-1-2-3	452	746	3.20	Adenocarcinoma	
Q-1-4-3	404	561	2.40	Adenocarcinoma	
Q-1-3-2	483	591	2.93	Adenocarcinoma	
Q-1-3-3	405	622	2.50	Adenosquamous carcinoma	PuIH 5
Q-1-3-4	394	650	2.48	Squamous cell carcinoma	
Q-1-1-3	412	715	2.70	Adenocarcinoma	
Q-1-2-4	382	741	2.57	Adenosquamous carcinoma	
Q-1-4-4	368	761	2.47	Adenoma	
R-1-1-2	263	689	1.81	Adenocarcinoma	
R-1-3-3	312	700	2.15	Adenocarcinoma	
R-1-4-2	321	824	2.36	Adenocarcinoma	
R-1-3-5	271	889	2.05	Adenocarcinoma	
R-1-1-4	240	913	1.83	Adenocarcinoma	
R-1-2-5	262	993	2.07	Adenosquamous carcinoma	
R-1-1-5	182	1010	1.44	Adenocarcinoma	
S-1-1-1	491	436	2.90	Squamous cell carcinoma	
S-1-1-2	395	497	2.44	Adenocarcinoma	
S-1-3-2	450	665	3.10	Adenosquamous carcinoma	
S-1-3-3	437	692	3.06	Adenocarcinoma	
S-1-4-3	433	714	3.07	Squamous cell carcinoma	PuIH 6
S-1-4-5	358	728	2.56	Adenosquamous carcinoma	
S-1-1-3	395	748	2.85	Adenocarcinoma	
S-1-3-4	421	779	3.08	Adenocarcinoma	
S-2-3-3	141	889	1.08	Adenocarcinoma	
S-1-1-5	335	904	2.59	Adenocarcinoma	
S-2-4-5	100	1040	0.80	Adenocarcinoma	
S-2-3-5	120	1040	0.96	Adenocarcinoma	
T-1-3-4	262	747	1.80	Squamous cell carcinoma	
T-1-3-5	235	761	1.62	Adenoma	
T-1-2-3	290	835	2.08	Adenocarcinoma	
V-3-4-2	257	518	1.56	Adenocarcinoma	
V-3-1-4	280	746	1.95	Adenocarcinoma	
V-3-4-4	250	752	1.74	Adenocarcinoma	
V-3-3-2	275	767	1.93	Adenocarcinoma	
V-3-3-3	275	807	1.97	Squamous cell carcinoma	

**Selected Section Slides from the Groups of Pu-Exposed Rats (Cont'd)**

Animal ID	ILD (Bq)	Survival (day)	Lung Dose (Gy)	Histopathological Diagnosis Primary Lung Tumors	Box #
V-3-3-4	238	810	1.71	Adenocarcinoma	PuIH 7
V-3-4-5	237	892	1.77	Adenocarcinoma	
V-3-2-4	232	925	1.75	Adenocarcinoma	
V-3-1-5	243	998	1.89	Adenocarcinoma	
W-1-2-2	446	559	2.78	Adenocarcinoma	
W-2-2-1	60	567	0.37	Adenoma	
W-1-4-4	377	740	2.61	Adenocarcinoma	
W-1-3-3	407	770	2.87	Adenocarcinoma	
W-1-3-4	397	778	2.81	Adenocarcinoma	
W-1-1-4	362	828	2.62	Adenosquamous carcinoma	
W-1-1-5	347	839	2.53	Adenocarcinoma	
W-2-2-4	51	873	0.38	Squamous cell carcinoma	
W-2-2-5	39	982	0.30	Adenocarcinoma	
W-2-3-5	56	1034	0.43	Adenoma	
W-2-1-5	50	1077	0.39	Adenoma	
X-3-1-4	26	826	0.19	Adenoma	
Y-2-3-1	371	486	2.28	Adenocarcinoma	PuIH 8
Y-1-3-1	447	611	2.99	Squamous cell carcinoma	
Y-1-3-2	404	649	2.76	Squamous cell carcinoma	
Y-1-4-1	530	710	3.75	Adenoma	
Y-2-3-2	271	780	1.98	Adenocarcinoma	
Y-2-1-2	284	780	2.08	Adenocarcinoma	
Y-1-4-2	367	783	2.69	Adenosquamous carcinoma	
Y-2-1-3	283	804	2.10	Adenocarcinoma	
Y-2-4-4	264	808	1.96	Adenocarcinoma	
Y-1-2-2	380	839	2.86	Squamous cell carcinoma	
Y-1-4-4	341	887	2.62	Adenocarcinoma	
Y-2-1-5	239	932	1.87	Adenocarcinoma	
Y-2-3-5	224	974	1.78	Adenocarcinoma	
Y-2-4-5	234	973	1.86	Squamous cell carcinoma	
Y-2-2-5	259	1001	2.08	Adenocarcinoma	
Y-1-2-4	322	1022	2.58	Adenocarcinoma	
Z-3-2-2	447	730	3.04	Adenocarcinoma	PuIH 9
Z-3-2-3	395	730	2.68	Adenocarcinoma	
Z-3-2-4	412	730	2.80	Adenocarcinoma	
Z-3-2-5	492	730	3.34	Adenocarcinoma	
A'-2-1-4	419	730	2.85	Adenocarcinoma	
A'-2-1-5	380	730	2.58	Adenocarcinoma	
A'-1-4-5	375	793	2.63	Adenocarcinoma	
A'-2-2-4	356	795	2.50	Adenosquamous carcinoma	
A'-1-4-3	410	658	2.68	Adenosquamous carcinoma	
B'-3-1-1	44	458	0.23	Adenoma	PuIH 10
C'-1-3-1	46	616	0.27	Adenoma	
C'-3-2-2	40	668	0.25	Adenoma	
B'-2-3-2	41	765	0.26	Metaplasia	
C'-3-2-3	39	693	0.24	Adenocarcinoma	
B'-1-1-3	28	838	0.19	Adenoma	
B'-1-4-2	28	882	0.19	Adenoma	
B'-1-4-3	19	898	0.13	Adenoma	
C'-3-1-3	42	821	0.28	Adenocarcinoma	PuIH 11
B'-1-1-4	18	936	0.12	Adenoma	
B'-1-1-5	6	989	0.04	Adenoma	
C'-2-3-4	23	924	0.16	Adenoma	
C'-1-1-3	19	943	0.13	Adenoma	



### Selected Section Slides from the Groups of Whole-Body X-Irradiated Rats

Animal ID	Survival (day)	Total Dose (Gy)	Histopathological Diagnosis Primary Lung Tumors	Box #
X-3-8-2	727/628	2.0	Adenoma	X 1
X-4-13-4	624/514	3.0	Adenoma	
X-4-6-2	626/530	1.0	Adenocarcinoma	
X-6-10-1	568/409	10	Adenocarcinoma	
X-1-10-5	764/644	5.0	Adenocarcinoma	
X-1-4-3	771/679	1.0	Adenoma	
X-3-2-3	592/504	0.5	Adenocarcinoma	
X-3-10-2	715/609	3.0	Adenoma	
X-4-10-4	715/612	2.0	Adenoma	X 2
X-3-10-5	883/777	3.0	Adenocarcinoma	
X-4-12-4	780/670	3.0	Adenosquamous carcinoma	
X-6-9-5	654/495	10	Adenoma	
X-4-14-3	827/717	3.0	Adenocarcinoma	
X-6-4-5	729/570	10	Adenoma	
X-6-3-4	789/630	10	Adenocarcinoma	
X-5-9-5	896/780	5.0	Adenocarcinoma	

### Selected Section Slides from the Groups of Thoracic X-Irradiated Rats

Animal ID	Survival (day)	Total Dose (Gy)	Histopathological Diagnosis Primary Lung Tumors	Box #
X-8-7-2	569/383	5.0	Undifferentiated carcinoma	X 3
X-8-6-2	669/483	5.0	Metaplasia	
X-8-6-3	677/491	5.0	Adenoma	
X-10-6-1	517/411	5.0	Squamous cell carcinoma	
X-12-8-3	490/382	10	Adenoma	
X-13-4-1	426/328	5.0	Squamous cell carcinoma	
X-9-5-4	745/593	5.0	Adenoma	
X-10-8-3	566/460	10	Adenoma	
X-8-8-2	825/639	5.0	Squamous cell carcinoma	X 4
X-8-6-4	826/640	5.0	Squamous cell carcinoma	
X-9-2-3	790/638	3.0	Adenoma	
X-8-3-2	834/648	3.0	meta.Osteosarcoma	
X-10-1-1	623/517	5.0	Adenoma	
X-9-6-1	830/678	5.0	Adenocarcinoma	
X-10-9-5	659/553	10	Adenocarcinoma	
X-8-4-4	896/710	3.0	Adenoma	X 5
X-12-8-4	612/504	10	Adenoma	
X-10-7-2	676/570	10	Squamous cell carcinoma	
X-8-1-2	904/718	3.0	Adenocarcinoma	
X-14-Ct5-5	503/(402)	0	meta.Squamous cell carcinoma	
X-8-1-3	912/726	3.0	Adenocarcinoma	
X-13-8-1	583/485	10	Adenoma	
X-14-12-3	528/427	1.0	Adenoma	
X-10-6-2	714/608	5.0	Adenocarcinoma	X 6
X-9-1-3	898/746	3.0	Adenocarcinoma	
X-9-7-5	908/756	5.0	Adenocarcinoma	
X-13-9-3	604/506	10	Adenocarcinoma	
X-10-4-2	731/625	3.0	Adenoma	

**Selected Section Slides from the Groups of Thoracic X-Irradiated Rats (Cont'd)**

Animal ID	Survival (day)	Total Dose (Gy)	Histopathological Diagnosis Primary Lung Tumors	Box #
X-11-7-4	699/599	10	Adenocarcinoma	X 7
X-8-8-3	972/786	5.0	Adenoma	
X-12-9-5	689/581	10	Adenoma	
X-10-7-4	762/656	10	Adenocarcinoma	
X-11-9-5	742/642	10	Adenoma	
X-11-7-5	744/644	10	Adenocarcinoma	
X-14-Ct3-3	597/(496)	0	meta.Squamous cell carcinoma	X 8
X-8-7-4	1020/834	5.0	Adenocarcinoma	
X-13-4-2	682/584	5.0	Adenocarcinoma	
X-11-8-5	784/684	10	Adenoma	
X-13-8-4	720/622	10	Adenocarcinoma	
X-12-6-4	787/679	5.0	Adenocarcinoma	
X-13-6-5	741/643	5.0	Adenoma	
X-13-7-5	755/657	10	Adenocarcinoma	X 9
X-13-3-1	763/665	3.0	Adenoma	
X-11-6-5	857/757	5.0	Adenoma	
X-14-7-2	731/630	1.0	Adenoma	
X-13-1-3	794/696	3.0	Squamous cell carcinoma	
X-13-8-5	828/730	10	Adenoma	X 10
X-12-2-3	898/790	3.0	Adenoma	
X-13-4-4	883/785	5.0	Adenoma	
X-10-4-5	1014/908	3.0	Adenocarcinoma	
X-12-3-5	955/847	3.0	Adenocarcinoma	
X-11-2-5	982/882	3.0	Adenocarcinoma	

### 4.1.3 Digital Pictures

The selected microscopic pictures of primary lung tumors from individual animals are saved as digital pictures in the folder of the MO disc files as indicated. The following tables list the information of the file name, object, staining, power magnification, histopathological diagnosis of the lung tumor specimens, as well as initial lung deposition and lung dose for  $^{239}\text{PuO}_2$ -exposures or total dose for X-irradiation, and survival period of the individual animals, in each MO disc file.

**Selected Digital Pictures from the Groups of Pu-Exposed Rats**  
**MO: DATA 4-1**

Folder: PuIH/LT1								
No.	File Name	Object	Stain	P.Mag.	Histopathological Diagnosis	ILD	Dose	Day
1	C-1-1-4/AC	Lung	HE	x200	Adenosquamous carcinoma	687	4.67	761
2	C-1-1-4/AD	"	"	"	"			
3	C-1-1-4/SCC	"	"	"	"			
4	D-2-2-3/ASC	"	"	x200	Adenosquamous carcinoma	1052	6.53	580
5	D-2-2-3/ASC2	"	"	"	"			
6	D-2-2-3/SCC	"	"	"	"			
7	D-2-2-3/AC	"	"	"	"			
8	D-2-2-3/AD	"	"	"	"			
9	E-1-2-2/SCC	"	"	x200	Adenosquamous carcinoma	1669	8.98	456
10	E-1-2-4/AC	"	"	x100	Adenosquamous carcinoma	1241	6.88	489
11	E-1-2-4/ASC	"	"	x200	"			
12	E-1-2-4/SCC	"	"	x200	"			
13	E-1-2-4/SCC2	"	"	x100	"			
14	F-2-1-2/SCC	"	"	x100	Squamous Ccell carcinoma	1307	6.84	487
15	G-1-1-3/AC	"	"	x200	Adenosquamous carcinoma	1840	8.80	444
16	G-1-1-3/ASC	"	"	"	"			
17	G-1-1-3/SCC	"	"	"	"			
18	G-2-2-3/AC	"	"	x100	Adenocarcinoma	1872	9.00	450
19	G-2-2-3/AC2	"	"	x200	"			
20	H-1-2-5/AC	"	"	x100	Adenosquamous carcinoma	756	4.51	705
21	H-1-2-5/SCC	"	"	"	"			
22	H-2-2-4/AC1	"	"	x100	Adenosquamous carcinoma	885	5.35	725
23	H-2-2-4/AC2	"	"	x200	"			
24	H-2-2-4/AC3	"	"	"	"			
25	H-2-2-4/SCC	"	"	x100	"			
26	I-2-4-2/AD	"	"	x100	Adenocarcinoma	918	4.98	581
27	I-2-4-2/AD2	"	"	x200	"			
28	I-2-4-2/AC	"	"	x100	"			
29	I-2-4-2/AC2	"	"	"	"			
30	I-2-1-3/AC	"	"	x200	Squamous cell carcinoma	734	4.15	636
31	I-2-1-3/AC2	"	"	"	"			
32	I-2-1-3/ASC	"	"	x100	"			
33	I-2-1-3/ASC2	"	"	x200	"			
34	I-1-2-4/AD	"	"	x100	Adenocarcinoma	907	5.45	732
35	I-1-2-4/AD2	"	"	"	"			
36	I-1-2-4/AC	"	"	"	"			
37	I-1-2-4/AC2	"	"	"	"			

**Selected Digital Pictures from the Groups of Pu-Exposed Rats**  
**MO: DATA 4-1 (Cont'd)**

Folder: PulH/LT2								
No.	File Name	Object	Stain	P.Mag.	Histopathological Diagnosis	ILD	Dose	Day
1	P-1-4-3/AC	Lung	HE	x100	Adenocarcinoma	442	3.05	701
2	P-1-4-3/AC2	"	"	x200	"			
3	P-1-4-3/AC3	"	"	x100	"			
4	P-1-4-3/AC4	"	"	x200	"			
5	Q-1-3-4/SCC	"	"	x100	Squamous cell carcinoma	394	2.48	650
6	Q-1-3-4/SCC2	"	"	x200	"			
7	Q-1-3-4/SCC3	"	"	x100	"			
8	Q-1-3-4/SCC4	"	"	x200	"			
9	Q-1-2-4/AC	"	"	x100	Adenosquamous carcinoma	382	2.57	741
10	Q-1-2-4/AC2	"	"	x200	"			
11	Q-1-2-4/AC3	"	"	"	"			
12	Q-1-2-4/AC4	"	"	"	"			
13	Q-1-2-4/SCC	"	"	x100	"			
14	Q-1-2-4/SCC2	"	"	x200	"			
15	R-1-4-2/AC	"	"	x100	Adenocarcinoma	321	2.36	824
16	R-1-4-2/AC2	"	"	x200	"			
17	R-1-4-2/AC3	"	"	x100	"			
18	R-1-4-2/AC4	"	"	x200	"			
19	R-1-4-2/AC5	"	"	x100	"			
20	R-1-4-2/AC6	"	"	x200	"			
21	R-1-2-5/AD	"	"	x200	Adenosquamous carcinoma	262	2.07	993
22	R-1-2-5/AC	"	"	x100	"			
23	R-1-2-5/AC2	"	"	x100	"			
24	R-1-2-5/AC3	"	"	x200	"			
25	S-1-1-1/SCC	"	"	x100	Squamous cell carcinoma	491	2.90	436
26	S-1-1-1/SCC2	"	"	x100	"			
27	S-1-1-1/SCC3	"	"	x200	"			
28	S-1-1-1/SCC4	"	"	x200	"			
29	S-1-1-1/AC	"	"	x100	"			
30	S-1-1-1/AC2	"	"	x200	"			
31	S-1-3-4/ASC	"	"	x100	Adenocarcinoma	421	3.08	779
32	S-1-3-4/ASC2	"	"	x200	"			
33	S-1-3-4/ASC3	"	"	x100	"			
34	S-1-3-4/ASC4	"	"	x200	"			
35	S-1-3-4/ASC5	"	"	x100	"			
36	S-1-3-4/ASC6	"	"	x200	"			

**Selected Digital Pictures from the Groups of Pu-Exposed Rats**  
**MO: DATA 4-1 (Cont'd)**

Folder: PuIH/LT3								
No.	File Name	Object	Stain	P.Mag.	Histopathological Diagnosis	ILD	Dose	Day
1	S-2-3-5/AC	Lung	HE	x100	Adenocarcinoma	120	0.96	1040
2	S-2-3-5/AC2	"	"	x200	"			
3	S-2-3-5/AC3	"	"	x100	"			
4	S-2-3-5/AC4	"	"	x200	"			
5	S-2-3-5/AC5	"	"	x200	"			
6	S-2-3-5/AC6	"	"	x100	"			
7	S-2-3-5/AC7	"	"	x100	"			
8	S-2-3-5/AC8	"	"	x200	"			
9	V-3-3-3/AD	"	"	x200	Squamous cell carcinoma	275	1.97	807
10	V-3-3-3/AD2	"	"	x100	"			
11	V-3-3-3/AD3	"	"	x100	"			
12	V-3-3-3/AD4	"	"	x200	"			
13	V-3-3-3/ASC	"	"	x100	"			
14	V-3-3-3/ASC2	"	"	x200	"			
15	V-3-3-3/SCC	"	"	x100	"			
16	V-3-3-3/SCC2	"	"	x200	"			
17	V-3-3-3/SCC3	"	"	x100	"			
18	V-3-3-3/SCC4	"	"	x200	"			
19	V-3-1-5/AD	"	"	x100	Adenocarcinoma	243	1.89	998
20	V-3-1-5/AD2	"	"	x200	"			
21	V-3-1-5/AD3	"	"	x100	"			
22	V-3-1-5/AD4	"	"	x200	"			
23	V-3-1-5/AC	"	"	x100	"			
24	V-3-1-5/AC2	"	"	x200	"			
25	X-3-1-4/AC	"	"	x100	Adenoma	26	0.19	826
26	X-3-1-4/AC2	"	"	x200	"			
27	Y-2-1-3/AC	"	"	x100	Adenocarcinoma	283	2.10	804
28	Y-2-1-3/AC2	"	"	x100	"			
29	Y-2-1-3/AC3	"	"	x200	"			
30	Y-2-1-3/AC4	"	"	x100	"			
31	Y-2-1-3/AC5	"	"	x100	"			
32	Y-2-1-3/AC6	"	"	x200	"			
33	Y-2-1-3/AC7	"	"	x100	"			
34	Y-2-1-3/AC8	"	"	x200	"			
35	Y-2-1-3/ASC	"	"	x100	"			
36	Y-2-1-3/SCC	"	"	x100	"			

**MO: DATA 4-1 (Cont'd)**

Folder: PuIH/LT4								
No.	File Name	Object	Stain	P.Mag.	Histopathological Diagnosis	ILD	Dose	Day
1	C'-3-2-3/AC	Lung	HE	x100	Adenocarcinoma	39	0.24	693
2	C'-3-2-3/AC2	"	"	x100	"			
3	C'-3-2-3/AC3	"	"	x200	"			
4	C'-3-2-3/AC4	"	"	x200	"			
5	B'-1-1-3/AC	"	"	x100	Adenoma	28	0.19	838
6	B'-1-1-3/AC2	"	"	x200	"			
7	B'-1-1-3/AC3	"	"	x100	"			
8	B'-1-1-3/AC4	"	"	x200	"			
9	B'-1-1-3/AD	"	"	x100	"			
10	B'-1-1-3/AD2	"	"	x200	"			
11	B'-1-4-2/AD	"	"	x100	Adenoma	28	0.19	882
12	B'-1-4-2/AD2	"	"	x200	"			
13	C'-3-1-3/AC	"	"	x200	Adenocarcinoma	42	0.28	821
14	C'-3-1-3/AC2	"	"	x200	"			
15	C'-2-3-4/AD1	Lung	HE	x200	Adenoma	23	0.16	924
16	C'-2-3-4/AD2	"	"	"	"			
17	C'-2-3-4/AC	"	"	"	"			

**Selected Digital Pictures from the Groups of X-Irradiated Rats**  
**MO: DATA 4-2**

Folder: X/LT1								
No.	File Name	Object	Stain	P.Mag.	Histopathological Diagnosis	X-irr.	Dose	Day
1	X-6-10-1/AC	Lung	HE	x200	Adenocarcinoma	WBX	10	568/409
2	X-1-10-5/AC	"	"	"	Adenocarcinoma		5	764/644
3	X-3-10-5/AC	"	"	"	Adenocarcinoma		3	883/777
4	X-4-12-4/ASC1	"	"	x100	Adenosquamous carcinoma	WBX	3	780/670
5	X-4-12-4/ASC2	"	"	x200	"			
6	X-4-12-4/ASC3	"	"	"	"			
7	X-4-12-4/ASC4	"	"	"	"			
8	X-5-9-5/AC1	"	"	x100	Adenocarcinoma	WBX	5	896/780
9	X-5-9-5/AC2	"	"	x200	"			
10	X-13-4-1/SCC	"	"	x200	Squamous cell carcinoma	ThX	5	426/328
11	X-8-6-4/AD1	"	"	x100	Squamous cell carcinoma	ThX	5	826/640
12	X-8-6-4/AD2	"	"	x200	"			
13	X-8-6-4/AC1	"	"	x100	"			
14	X-8-6-4/AC2	"	"	x200	"			
15	X-8-6-4/AC3	"	"	"	"			
16	X-8-6-4/SCC1	"	"	"	"			
17	X-9-2-3/AD1	"	"	x100	Adenoma	ThX	3	790/638
18	X-9-2-3/AD2	"	"	"	"			
19	X-9-2-3/AD3	"	"	x200	"			
20	X-9-2-3/AD4	"	"	"	"			
21	X-9-2-3/AD5	"	"	x100	"			
22	X-9-2-3/AD6	"	"	x200	"			
23	X-10-1-1/AC1	"	"	x100	Adenocarcinoma	ThX	5	623/517
24	X-10-1-1/AC2	"	"	x200	"			
25	X-10-7-2/SCC1	"	"	x100	Squamous cell carcinoma	ThX	10	676/570
26	X-10-7-2/SCC2	"	"	x200	"			
27	X-10-7-2/AD1	"	"	"	"			
28	X-10-7-2/AD2	"	"	"	"			
29	X-8-1-2/AD1	"	"	x100	Adenocarcinoma	ThX	3	904/718
30	X-8-1-2/AD2	"	"	x200	"			
31	X-8-1-2/AC1	"	"	x100	"			
32	X-8-1-2/AC2	"	"	x200	"			
33	X-8-1-2/AC3	"	"	"	"			
34	X-8-1-2/ACSCC	"	"	"	"			
35	X-10-6-2/AD1	"	"	x100	Adenocarcinoma	ThX	5	714/618
36	X-10-6-2/AD2	"	"	x200	"			

**Selected Digital Pictures from the Groups of X-Irradiated Rats**  
**MO: DATA 4-2 (Cont'd)**

Folder: X/LT2								
No.	File Name	Object	Stain	P.Mag.	Histopathological Diagnosis	X-irr.	Dose	Day
1	X-9-1-3/AC1	Lung	HE	x100	Adenocarcinoma	ThX	3	898/746
2	X-9-1-3/AC2	"	"	x200	"			
3	X-9-7-5/AC1	"	"	x100	Adenocarcinoma	ThX	5	908/756
4	X-9-7-5/AC2	"	"	x200	"			
5	X-13-9-3/AD1	"	"	x100	Adenoma	ThX	10	604/506
6	X-13-9-3/AD2	"	"	x200	"			
7	X-10-7-4/AD1	"	"	x200	Adenoma	ThX	10	762/656
8	X-10-7-4/AD2	"	"	"	"			
9	X-10-7-4/AD3	"	"	x100	"			
10	X-10-7-4/AD4	"	"	x200	"			
11	X-11-7-5/AC1	"	"	x100	Adenocarcinoma	ThX	10	744/644
12	X-11-7-5/AC2	"	"	x200	"			
13	X-8-7-4/AC1	"	"	x100	Adenocarcinoma	ThX	5	1020/834
14	X-8-7-4/AC2	"	"	x200	"			
15	X-8-7-4/AC3	"	"	x100	"			
16	X-8-7-4/AC4	"	"	x200	"			
17	X-11-8-5/AC1	"	"	x200	Adenocarcinoma	ThX	10	784/684
18	X-11-8-5/AC2	"	"	x100	"			
19	X-11-8-5/AC3	"	"	x200	"			
20	X-11-8-5/SCC1	"	"	x100	"			
21	X-11-8-5/SCC2	"	"	x200	"			
22	X-13-8-4/AC1	"	"	x200	Squamous cell carcinoma	ThX	10	720/622
23	X-13-8-4/AC2	"	"	"	"			
24	X-13-8-4/AC3	"	"	"	"			
25	X-13-8-4/SCC1	"	"	x100	"			
26	X-13-8-4/SCC2	"	"	x200	"			
27	X-13-8-4/SCC3	"	"	x100	"			
28	X-13-8-4/SCC4	"	"	x200	"			
29	X-13-3-1/AC1	"	"	x100	Adenocarcinoma	ThX	3	763/665
30	X-13-3-1/AC2	"	"	x200	"			
31	X-13-1-3/SCC1	"	"	x100	Squamous cell carcinoma	ThX	3	794/696
32	X-13-1-3/SCC2	"	"	x200	"			
33	X-13-8-5/AC1	"	"	x100	Adenocarcinoma	ThX	10	828/730
34	X-13-8-5/AC2	"	"	"	"			
35	X-13-8-5/AC3	"	"	x200	"			
36	X-13-8-5/AC4	"	"	"	"			

**MO: DATA 4-2 (Cont'd)**

Folder: X/LT3								
No.	File Name	Object	Stain	P.Mag.	Histopathological Diagnosis	X-irr.	Dose	Day
1	X-12-2-3/AD	Lung	HE	x200	Adenoma	ThX	3	898/790
2	X-12-2-3/ASC	"	"	"	"			
3	X-10-4-5/AD	"	"	"	Adenocarcinoma	ThX	3	1014/908
4	X-10-4-5/AC	"	"	"	"			

#### 4.1.4 Cell Lines and DNA Samples

The trials for establishment of lung tumor cell lines available for cell cultures and *in vitro* studies resulted in one line, PuD2, obtained from an adenocarcinoma lesion in the <sup>239</sup>PuO<sub>2</sub>-exposed rat (case # D-2-1-2). This line has been demonstrated to be derived from surfactant apoprotein A-positive type II pneumocytes and have a doubling time of about 20 hr in cultures after several passages, showing an appearance of compact solid carcinomas *in situ* in subcutaneously injected nude mice.

The following table includes cell lines established from rat tracheal or pulmonary epithelium, available for *in vitro* studies as well as transplantation assays.

#### List of Rat Tracheal or Pulmonary Epithelial Cell Lines

Cell Line ID	Cellular Origin	Original Source
PuD2	Lung adenocarcinoma from Pu-exposed rat	NIRS
SV40T2	Immortalized type II cells from neonatal rat lung	A.Clement (Univ.Paris)
RTiv3	Gamma-ray-induced transformant from rat tracheal epithelial cells	J.L.Poncy (DRR/CEA)
BP	<i>In utero</i> benzo [a] pyrene-induced epithelial cells from fetal rat lung	E.May (DRR/CEA)
BP(P)Tu	BP-derived & tumorigenic cells	E.May (DRR/CEA)
BP130	BP-derived & cultured cells	E.May (DRR/CEA)
BP270	BP-derived & cultured cells	E.May (DRR/CEA)

#### Characterization of Rat Tracheal or Pulmonary Epithelial Cell Lines

Cell Line	CE (1)	Anchorage Dependent Cell Growth (2)	Tumorigenicity (3)	p53 Genome	p16 Genome (4)	Expression of p16 mRNA (5)	p16 Methylation (6)
PuD2	73	Independent	++	Wild type	Deletion	—	—
SV40T2	39	Dependent	—	Wild type	+	+	U
RTiv3	14	Dependent	—	Wild type	+	—	M
BP	75	Independent	+	Wild type	+	+	UM
BP(P)Tu	76	Independent	+	Codon 130 AAG to AGG	+	—	M
BP130	ND	Independent	+	Codon 130 AAG to AGG	+	—	M
BP270	ND	Independent	+	Codon 270 GTT to TTT	+	—	M

(1) Colony efficiency in liquid culture, number of colonies per 100 cells, ND; not done

(2) Cell growth in agarose culture medium

(3) Cell growth in nude mouse

(4) Amplified by PCR of genomic DNA

(5) Amplified by RT-PCR of cDNA

(6) U; unmethylated, M; methylated, -; not amplified by methylation specific PCR



The following table includes genomic DNA samples extracted from fresh lung tumor lesions of  $^{239}\text{PuO}_2$ -exposed rats, available for analyses on tumor-related gene alterations.

**List of Genomic DNA Samples from Lung Tumors of Pu-Exposed Rats**

Animal ID	Histopathological Diagnosis	Remarks for <i>p53</i> (Exon 5-8) Mutations
C-1-1-2	Adenocarcinoma	Wild
D-2-1-2	Adenocarcinoma	Wild
E-1-2-3	Adenosquamous carcinoma	Wild
E-1-2-4	Adenosquamous carcinoma	Wild
E-2-1-4	Adenocarcinoma	Wild
G-1-1-3	Adenosquamous carcinoma	Wild
G-2-1-1	Adenosquamous carcinoma	Wild
H-2-1-5	Adenosquamous carcinoma	Wild
H-2-2-4	Adenosquamous carcinoma	Wild
I-1-1-3	Squamous cell carcinoma	Wild
I-1-2-4	Adenocarcinoma	Wild
I-1-3-5	Adenosquamous carcinoma	Wild
I-2-1-3	Squamous cell carcinoma	Wild
I-2-1-5	Adenocarcinoma	Wild
I-2-4-2	Adenocarcinoma	Wild

## 4.2 Bone Tumors from Mice

The following tables list up the selected specimens prepared for histopathological and immunohistochemical examinations of the primary bone tumors obtained from the experiments for injections of  $^{239}\text{Pu}$  citrate solution in three different strains of mice (Groups IP7 to IP14). These include the paraffin-embedded blocks, histological sections on glass slides stained with hematoxylin-eosin and others for immunohistochemistry, MO disc files of microscopic pictures, established cell lines and DNA samples, respectively together with the information of individual animal case of bone tumors.

### 4.2.1 Paraffin-Blocks

The selected paraffin-blocks of primary bone tumors from individual animals are put in a sealed plastic bag, stored in a bundle of the groups in the box. The following tables list the information of case number, mouse strain, injected dose and skeletal dose, survival period, and histopathological diagnosis of bone tumors of the individual animals as well as the number (#) of the container box.

**Selected Paraffin-Blocks from the Groups of Pu-Injected Mice**

Animal ID	Mouse Strain	IP Dose (Bq)	Post IP (day)	Sk. Dose (Gy)	Histopathological Diagnosis Bone Tumors	Box #
IP7-1-1-3	C3H	100	754	0.65	Osteofibrosarcoma	7
IP7-1-1-8	"	"	845	0.70	Osteosarcoma	
IP7-1-2-7	"	"	781	0.66	Osteosarcoma	
IP7-2-1-9	C57	"	852	0.70	meta.Osteosarcoma	
IP7-3-1-3	BC3	"	642	0.58	Osteosarcoma	
IP7-3-1-6	"	"	780	0.66	Osteosarcoma	
IP7-3-1-9	"	"	867	0.71	meta.Osteosarcoma	
IP7-3-2-5	"	"	692	0.61	meta.Osteosarcoma	
IP7-3-2-8	"	"	857	0.71	Osteosarcoma	
IP7-3-3-10	"	"	792	0.67	Osteofibrosarcoma	
IP8-1-1-1	C3H	500	455	2.22	Osteosarcoma	7
IP8-1-1-6	"	"	577	2.67	Osteosarcoma	
IP8-1-1-8	"	"	627	2.84	Osteosarcoma	
IP8-1-1-9	"	"	632	2.86	Osteosarcoma	
IP8-1-2-2	"	"	531	2.51	Osteosarcoma	
IP8-1-2-7	"	"	677	3.01	meta.Osteosarcoma	
IP8-1-3-2	"	"	423	2.09	meta.Osteosarcoma	
IP8-1-3-3	"	"	443	2.17	Osteosarcoma	
IP8-1-3-5	"	"	531	2.51	Giant cell sarcoma	
IP8-1-3-8	"	"	648	2.91	Osteosarcoma	
IP8-1-3-10	"	"	739	3.20	Osteosarcoma	
IP8-2-2-4	C57	"	610	2.79	Osteofibrosarcoma	
IP8-2-3-4	"	"	487	2.34	Osteosarcoma	
IP8-2-3-10	"	"	625	2.84	Osteosarcoma	
IP8-2-3-11	"	"	646	2.91	Osteofibrosarcoma	
IP8-3-1-4	BC3	"	487	2.34	meta.Osteosarcoma	
IP8-3-2-3	"	"	527	2.49	Osteosarcoma	
IP8-3-3-4	"	"	505	2.41	Osteosarcoma	
IP8-3-3-7	"	"	530	2.51	Osteosarcoma	
IP8-3-3-9	"	"	579	2.68	Osteosarcoma	
IP8-3-3-11	"	"	590	2.72	Osteosarcoma	

**Selected Paraffin-Blocks from the Groups of Pu-Injected Mice (Cont'd)**

Animal ID	Mouse Strain	IP Dose (Bq)	Post IP (day)	Sk. Dose (Gy)	Histopathological Diagnosis Bone Tumors	Box #
IP9-1-1-3	C3H	1000	408	4.07	meta.Giant cell sarcoma	7
IP9-1-1-4	"	"	467	4.54	meta.Giant cell sarcoma	
IP9-1-1-9	"	"	529	5.00	Osteosarcoma	
IP9-1-1-10	"	"	575	5.33	Osteosarcoma	
IP9-1-2-4	"	"	434	4.28	Osteosarcoma	
IP9-1-2-6	"	"	480	4.64	meta.Osteosarcoma	
IP9-1-3-1	"	"	259	2.76	meta.Osteosarcoma	
IP9-1-3-6	"	"	444	4.36	Osteosarcoma	
IP9-1-3-7	"	"	445	4.37	Osteosarcoma	
IP9-2-1-3	C57	"	339	3.48	Osteosarcoma	
IP9-2-1-7	"	"	405	4.04	meta.Osteosarcoma	
IP9-2-1-10	"	"	442	4.34	Osteosarcoma	
IP9-2-2-4	"	"	363	3.69	Osteosarcoma	
IP9-2-2-9	"	"	521	4.95	Osteosarcoma	
IP9-2-3-2	"	"	355	3.62	Osteosarcoma	
IP9-2-3-4	"	"	411	4.09	Osteosarcoma	
IP9-2-3-7	"	"	466	4.53	Giant cell sarcoma	
IP9-2-3-10	"	"	551	5.16	meta.Osteosarcoma	
IP9-2-3-12	"	"	573	5.32	meta.Osteosarcoma	
IP9-3-1-6	BC3	"	405	4.04	Osteosarcoma	
IP9-3-1-7	"	"	415	4.13	Osteosarcoma	
IP9-3-1-8	"	"	438	4.31	meta.Osteosarcoma	
IP9-3-2-6	"	"	440	4.33	meta.Osteosarcoma	
IP9-3-2-8	"	"	499	4.78	Osteosarcoma	
IP9-3-2-9	"	"	505	4.83	Osteosarcoma	
IP9-3-3-9	"	"	532	5.03	Osteosarcoma	
IP10-1-4	C3H	5000	308	16.0	meta.Osteosarcoma	8
IP10-1-5	"	"	325	16.8	Osteosarcoma	
IP10-1-6	"	"	340	17.5	Osteosarcoma	
IP10-1-7	"	"	364	18.5	Osteosarcoma	
IP10-1-8	"	"	366	18.6	Osteosarcoma	
IP10-1-10	"	"	367	18.6	Osteosarcoma	
IP10-1-11	"	"	367	18.6	Osteosarcoma	
IP10-2-6	"	"	330	17.0	Giant cell sarcoma	
IP10-2-10	"	"	365	18.5	Osteosarcoma	
IP10-3-12	"	"	276	14.6	Osteosarcoma	
IP11-1-2-6	C3H	5000	298	15.6	Osteosarcoma	8
IP11-1-2-7	"	"	333	17.2	meta.Osteosarcoma	
IP11-1-3-7	"	"	348	17.8	Osteosarcoma	
IP11-1-3-8	"	"	362	18.4	Osteosarcoma	
IP11-1-3-10	"	"	429	21.2	Osteosarcoma	
IP11-2-3-2	C57	"	323	16.7	Giant cell sarcoma	
IP11-2-3-3	"	"	357	18.2	meta.Osteosarcoma	
IP11-2-3-4	"	"	363	18.5	Osteosarcoma	
IP11-2-3-5	"	"	373	18.9	Osteosarcoma	
IP11-2-3-7	"	"	386	19.4	Osteosarcoma	
IP11-2-3-8	"	"	390	19.4	Osteosarcoma	
IP11-2-3-9	"	"	434	21.4	Osteosarcoma	
IP11-3-3-2	BC3	"	304	15.9	Osteosarcoma	
IP11-3-3-3	"	"	319	16.5	Osteosarcoma	
IP11-3-3-7	"	"	353	18.0	Osteosarcoma	
IP11-3-3-10	"	"	397	19.9	Osteosarcoma	

**Selected Paraffin-Blocks from the Groups of Pu-Injected Mice (Cont'd)**

Animal ID	Mouse Strain	IP Dose (Bq)	Post IP (day)	Sk. Dose (Gy)	Histopathological Diagnosis Bone Tumors	Box #
IP12-1-1	C3H	10000	220	23.8	Osteosarcoma	8
IP12-2-4	"	"	270	28.6	Osteosarcoma	
IP12-3-4	"	"	283	29.8	Osteoma	
IP12-3-6	"	"	321	33.3	Osteosarcoma	
IP12-2-7	"	"	321	33.3	Osteosarcoma	
IP12-3-9	"	"	407	40.6	Osteosarcoma	
IP12-3-10	"	"	423	41.9	Osteosarcoma	
IP12-3-11	"	"	443	43.5	Osteosarcoma	
IP13-2-2	C57	10000	379	38.3	Giant cell sarcoma	8
IP13-2-3	"	"	381	38.5	Osteosarcoma	
IP13-1-4	"	"	446	43.7	Osteosarcoma	
IP14-1-3	BC3	10000	375	37.9	Osteosarcoma	8
IP14-2-3	"	"	425	42.1	Osteosarcoma	
IP14-2-9	"	"	539	50.8	Osteosarcoma	

#### 4.2.2 Histological Section Slides

The selected histological section slides of primary bone tumors from individual animals are put in a plastic box as indicated by the number. The following tables list the information of case number, mouse strain, injected dose, survival period, and histopathological diagnosis of bone tumors of the individual animals as well as the number (#) of the slide box.

**Selected Section Slides from the Groups of Pu-Injected Mice**

Animal ID	Mouse Strain	IP Dose (Bq)	Post IP (day)	Histopathological Diagnosis Bone Tumors & Others	Box #
IP8-2-2-1	C57	500	364	Pulm.adenocarcinoma	PuIP 1
IP9-1-3-1	C3H	1000	259	Osteosarcoma	
IP8-1-3-2	C3H	500	423	Osteosarcoma	
IP7-3-1-3	BC3	100	642	Osteosarcoma	
IP8-1-3-3	C3H	500	443	Osteosarcoma	PuIP 2
IP7-3-2-5	BC3	100	692	Osteosarcoma	
IP8-2-3-4	C57	500	487	Osteosarcoma	
IP8-3-1-4	BC3	500	487	Osteosarcoma	
IP7-2-2-5	C57	100	704	Pulm.adenocarcinoma	PuIP 3
IP8-3-3-3	BC3	500	500	Osteosarcoma	
IP9-2-1-3	C57	1000	339	Osteosarcoma	
IP7-3-3-6	BC3	100	711	Pulm.adenocarcinoma	
IP8-3-3-4	BC3	500	505	Osteosarcoma	
IP7-3-3-7	BC3	100	715	Osteosarcoma	
IP9-2-3-1	C57	1000	348	Osteosarcoma	
IP7-3-3-8	BC3	100	725	Osteosarcoma	PuIP 4
IP9-2-3-2	C57	1000	355	Osteosarcoma	
IP8-1-2-1	C3H	500	527	Osteosarcoma	
IP8-3-2-3	BC3	500	527	Osteosarcoma	
IP9-2-2-4	C57	1000	363	Osteosarcoma	
IP7-1-Ct1-3	C3H	0	737	Pulm.adenocarcinoma	
IP8-3-3-7	BC3	500	530	Osteosarcoma	
IP8-1-2-2	C3H	500	531	Osteosarcoma	PuIP 5
IP8-1-3-5	C3H	500	531	Osteosarcoma	
IP8-1-1-3	C3H	500	532	Osteosarcoma	
IP7-1-1-3	C3H	100	754	Osteosarcoma	PuIP 6
IP9-2-1-6	C57	1000	385	Osteosarcoma	
IP9-2-1-7	C57	1000	405	Osteosarcoma	
IP9-1-1-3	C3H	1000	408	Osteosarcoma	PuIP 7
IP9-1-1-3	C3H	1000	408	Osteosarcoma	
IP7-3-1-6	BC3	100	780	Osteosarcoma	
IP8-2-2-3	C57	500	573	Osteosarcoma	
IP7-1-2-7	C3H	100	781	Osteosarcoma	
IP8-1-1-6	C3H	500	577	Osteosarcoma	
IP8-3-3-9	BC3	500	579	Osteosarcoma	
IP9-3-1-7	BC3	1000	415	Osteosarcoma	
IP7-3-3-10	BC3	100	792	Osteosarcoma	
IP8-3-2-7	BC3	500	586	Pulm.adenocarcinoma	PuIP 8
IP8-3-3-11	BC3	500	590	Osteosarcoma	
IP9-1-2-4	C3H	1000	434	Osteosarcoma	
IP9-3-1-8	BC3	1000	438	Osteosarcoma	
IP9-3-2-6	BC3	1000	440	Osteosarcoma	

### Selected Section Slides from the Groups of Pu-Injected Mice (Cont'd)

Animal ID	Mouse Strain	IP Dose (Bq)	Post IP (day)	Histopathological Diagnosis Bone Tumors & Others	Box #
IP8-2-3-10	C57	500	625	Osteosarcoma	PuIP 9
IP10-3-11	C3H	5000	276	Osteosarcoma	
IP9-2-3-7	C57	1000	466	Osteosarcoma	
IP9-1-1-4	C3H	1000	467	Osteosarcoma	
IP8-1-1-9	C3H	500	632	Osteosarcoma	
IP7-1-1-8	C3H	100	845	Osteosarcoma	
IP8-3-1-8	BC3	500	641	Osteosarcoma	
IP9-1-2-6	C3H	1000	480	Osteosarcoma	
IP7-2-1-9	C57	100	852	Osteosarcoma	PuIP 10
IP8-2-3-11	C57	500	646	Osteosarcoma	
IP10-1-4	C3H	5000	308	Osteosarcoma	
IP7-3-2-8	BC3	100	857	Osteosarcoma	
IP7-3-1-9	BC3	100	867	Osteosarcoma	
IP10-1-5	C3H	5000	325	Osteosarcoma	
IP10-2-6	C3H	5000	330	Osteosarcoma	
IP8-1-2-7	C3H	500	677	Osteosarcoma	PuIP 11
IP10-1-7	C3H	5000	364	Osteosarcoma	
IP10-2-10	C3H	5000	365	Osteosarcoma	
IP9-2-3-10	C57	1000	551	Osteosarcoma	
IP9-2-3-12	C57	1000	573	Osteosarcoma	PuIP 12
IP9-1-1-10	C3H	1000	575	Osteosarcoma	
IP8-1-3-10	C3H	500	739	Osteosarcoma	
IP11-1-2-5	C3H	5000	297	Osteosarcoma	PuIP 13
IP11-1-2-6	C3H	5000	298	Osteosarcoma	
IP11-3-3-2	BC3	5000	304	Osteosarcoma	
IP11-2-2-5	C57	5000	307	Osteosarcoma	
IP11-3-3-3	BC3	5000	319	Osteosarcoma	
IP11-3-3-4	BC3	5000	320	Osteosarcoma	
IP11-2-3-2	C57	5000	323	Osteosarcoma	PuIP 14
IP11-1-3-7	C3H	5000	348	Osteosarcoma	
IP11-3-3-7	BC3	5000	353	Osteosarcoma	
IP11-3-3-8	BC3	5000	354	Osteosarcoma	
IP11-2-3-3	C57	5000	357	Osteosarcoma	
IP11-1-3-8	C3H	5000	362	Osteosarcoma	
IP11-2-3-4	C57	5000	363	Osteosarcoma	PuIP 15
IP11-2-3-5	C57	5000	373	Osteosarcoma	
IP11-2-3-7	C57	5000	386	Osteosarcoma	
IP11-2-3-8	C57	5000	390	Osteosarcoma	
IP11-3-3-10	BC3	5000	397	Osteosarcoma	
IP11-1-3-10	C3H	5000	429	Osteosarcoma	
IP11-2-3-9	C57	5000	434	Osteosarcoma	
IP12-1-1	C3H	10000	220	Osteosarcoma	PuIP 17
IP12-2-4	C3H	10000	270	Osteosarcoma	
IP12-3-4	C3H	10000	283	Osteoma	
IP12-3-6	C3H	10000	321	Osteosarcoma	PuIP 18
IP12-2-7	C3H	10000	321	Osteosarcoma	
IP12-3-9	C3H	10000	407	Osteosarcoma	
IP12-3-10	C3H	10000	423	Osteosarcoma	
IP12-3-10	C3H	10000	423	Osteosarcoma	PuIP 19
IP13-2-2	C57	10000	379	Osteosarcoma	
IP12-3-11	C3H	10000	443	Osteosarcoma	
IP13-2-3	C57	10000	381	Osteosarcoma	
IP14-1-3	BC3	10000	375	Osteosarcoma	PuIP 20
IP13-1-4	C57	10000	446	Osteosarcoma	
IP14-2-3	BC3	10000	425	Osteosarcoma	PuIP 21
IP14-2-9	BC3	10000	539	Osteosarcoma	

### 4.2.3 Digital Pictures

The selected microscopic pictures of primary bone tumors from individual animals are saved as digital pictures in the folder of the MO disc files as indicated. The following tables list the information of the file name, object, staining, power magnification, histopathological diagnosis of the bone tumor specimens, as well as the strain, injected dose and survival period of the individual animals, in each MO disc file.

**Selected Digital Pictures from the Groups of Pu-Injected Mice  
MO: DATA 5-1**

Folder: PuIP/BT1								
No.	File Name	Object	Stain	P.Mag.	Histopathological Diagnosis	Strain	Dose	Day
1	IP8-1-3-2/OS	Bone T	HE	x200	Osteosarcoma	C3H	500	423
2	IP7-3-1-3/OS	Bone T	"	"	Osteosarcoma	BC3	100	642
3	IP8-2-3-4/GCS	Bone T	"	"	Osteosarcoma	C57	500	487
4	IP8-3-1-4/OS	Bone T	"	"	meta. Osteosarcoma	BC3	500	487
5	IP8-3-1-4/mOS	Lung	"	x100				
6	IP8-3-1-4/mOS2	"	"	"				
7	IP7-3-3-7/OS	Bone T	"	x200	Osteosarcoma	BC3	100	715
8	IP7-3-3-8/OS1	Bone T	"	"	Osteosarcoma	BC3	100	725
9	IP7-3-3-8/OS2	"	"	"				
10	IP8-3-2-3/OS1	Bone T	"	"	Osteosarcoma	BC3	500	527
11	IP8-3-2-3/OS2	"	"	"				
12	IP9-2-2-4/OS1	Bone T	"	"	Osteosarcoma	C57	1000	363
13	IP9-2-2-4/OS2	"	"	"				
14	IP8-3-3-7/OS1	Bone T	"	"	Osteosarcoma	BC3	500	530
15	IP8-3-3-7/OS2	"	"	"				
16	IP8-1-3-5/GCS1	Bone T	"	"	Giant Cell Osteosarcoma	C3H	500	531
17	IP8-1-3-5/GCS2	"	"	"				
18	IP8-1-1-3/OS1	Bone T	"	"	Osteosarcoma	C3H	500	532
19	IP8-1-1-3/OS2	"	"	"				
20	IP7-1-1-3/OFS1	Bone T	"	"	Osteofibrosarcoma	C3H	100	754
21	IP7-1-1-3/OFS2	"	"	"				
22	IP9-2-1-7/OS1	Bone T	"	"	meta. Osteosarcoma	C57	1000	405
23	IP9-2-1-7/OS2	"	"	"				
24	IP9-2-1-7/mOS1	Lung	"	x40				
25	IP9-2-1-7/mOS2	"	"	x200				
26	IP9-1-1-3/OS	Bone T	"	"	meta. Giant Cell Sarcoma	C3H	1000	408
27	IP9-1-1-3/mOS1	Lung	"	"				
28	IP9-1-1-3/mOS2	"	"	"				
29	IP7-3-1-6/OS1	Bone T	"	"	Osteosarcoma	BC3	100	780
30	IP7-3-1-6/OS1	"	CM5	"				
31	IP7-3-1-6/OS2	"	HE	"				
32	IP7-3-1-6/OS2	"	CM5	"				
33	IP7-3-1-6/OS3	"	HE	"				
34	IP7-3-1-6/OS4	"	HE	"				
35	IP7-3-1-6/OS4	"	CM5	"				

**Selected Digital Pictures from the Groups of Pu-Injected Mice**  
**MO: DATA 5-1 (Cont'd)**

Folder: PuIP/BT2								
No.	File Name	Object	Stain	P.Mag.	Histopathological Diagnosis	Strain	Dose	Day
1	IP7-1-2-7/OS1	Bone T	HE	x200	Osteosarcoma	C3H	100	781
2	IP7-1-2-7/OS2	"	"	"				
3	IP7-1-2-7/OS3	"	"	"				
4	IP9-3-1-7/OS	Bone T	"	"	Osteosarcoma	BC3	1000	415
5	IP8-3-3-11/OS1	Bone T	"	"	Osteosarcoma	BC3	500	590
6	IP8-3-3-11/OS2	"	"	"				
7	IP9-3-1-8/OS	Bone T	"	"	Osteosarcoma	BC3	1000	438
8	IP9-2-3-7/GCS	Bone T	"	"	Giant Cell Osteosarcoma	C57	1000	466
9	IP9-1-1-4/GCS	Bone T	"	"	Giant Cell Osteosarcoma	C3H	1000	467
10	IP9-1-1-4/OS	"	"	"				
11	IP7-1-1-8/OS1	Bone T	"	"	Osteosarcoma	C3H	100	845
12	IP7-1-1-8/OS2	"	"	"				
13	IP7-2-1-9/OS1	Bone T	"	"	meta. Osteosarcoma	C57	100	852
14	IP7-2-1-9/OS2	"	"	"				
15	IP7-2-1-9/mOS	Liver	"	"				
16	IP10-1-4/OS	Bone T	"	"	Osteosarcoma	C3H	5000	308
17	IP7-3-1-9/mOS	Lung	"	"	meta. Osteosarcoma	BC3	100	867
18	IP7-3-1-9/mOS	Kidney	"	"				
19	IP10-2-10/OS	Bone T	"	"	Osteosarcoma	C3H	5000	365
20	IP9-2-3-12/mOS	Liver	"	"	meta. Osteosarcoma	C57	1000	573
21	IP9-2-3-12/mOS	Spleen	"	"				
22	IP9-2-3-12/mOS	Kidney	"	"				
23	IP9-2-3-12/OS1	Bone T	"	"				
24	IP9-2-3-12/OS2	"	"	"				
25	IP11-3-3-4/OS	Bone T	"	"	Osteosarcoma(microscopic)	BC3	5000	320
26	IP11-1-3-7/OS1	Bone T	HE	"	Osteosarcoma	C3H	5000	348
27	IP11-1-3-7/OS2	"	HE	"				
28	IP11-1-3-7/OS2	"	CM5	"				
29	IP11-1-3-7/OS3	"	HE	"				
30	IP11-1-3-7/OS3	"	CM5	"				
31	IP11-3-3-8/GCS	Bone T	HE	"	Osteosarcoma	BC3	5000	354
32	IP11-3-3-8/OS1	"	"	"				
33	IP11-3-3-8/OS2	"	"	"				
34	IP11-2-3-5/OFS	Bone T	"	"	Osteosarcoma	C57	5000	373
35	IP11-2-3-7/OS1	Bone T	"	"	Osteosarcoma	C57	5000	386
36	IP11-2-3-7/OS2	"	"	"				

**MO: DATA 5-1 (Cont'd)**

Folder: PuIP/BT3								
No.	File Name	Object	Stain	P.Mag.	Histopathological Diagnosis	Strain	Dose	Day
1	IP11-2-3-8/OS1	Bone T	HE	x200	Osteosarcoma	C57	5000	390
2	IP11-2-3-8/OS2	"	"	"				
3	IP12-3-9/OS1	Bone T	"	"	Osteosarcoma	C3H	10000	407
4	IP12-3-9/OS2	"	"	"				
5	IP12-3-10/OS1	Bone T	"	"	Osteosarcoma	C3H	10000	423
6	IP12-3-10/OS2	"	"	"				
7	IP12-3-10/OS3	"	"	"				
8	IP12-3-10/OS4	"	"	"				
9	IP13-2-2/OS	Bone T	"	"	Giant Cell Osteosarcoma	C57	10000	379
10	IP13-2-3/OS1	Bone T	"	"	Osteosarcoma	C57	10000	381
11	IP13-2-3/OS2	"	"	"				
12	IP14-2-9/OS1	Bone T	HE	x200	Osteosarcoma	BC3	10000	539
13	IP14-2-9/OS2	"	"	"				
14	IP14-2-9/OS3	"	"	"				
15	IP14-2-9/OS4	"	"	"				



#### 4.2.4 Cell Lines and DNA Samples

The trials for establishment of bone tumor cell lines available for cell cultures and *in vitro* studies resulted in one line, mOS, obtained from an osteosarcoma lesion in the  $^{239}\text{Pu}$ -injected mouse (case # IP14-2-9). This line has been demonstrated to show an appearance of spindle-shaped osteoblasts or partly tartaric acid-resistant acid phosphatase (TRAP)-positive multinucleated giant cells (osteoclasts) with a doubling time of about 50 hr in cultures, and after a long-term cultures for several months, the cells were available for transplantation tumorigenesis assays using nude mice.

The following table includes genomic DNA samples extracted from fresh bone tumor lesions of  $^{239}\text{Pu}$ -injected mice, available for analyses on tumor-related gene alterations.

**List of Genomic DNA Samples from Bone Tumors of Pu-Injected Mice**

Animal ID	Histopathological Diagnosis	Remarks for <i>p53</i> (Exon 5-8) Mutations	Remarks for K-, H-, N- <i>ras</i> (Exon 1-2) Mutations
IP12-2-4	Osteosarcoma	Wild	Wild
IP12-3-11	Osteosarcoma	Wild	Wild
IP12-3-6	Osteosarcoma	Ex7 codon 245 (CGT to AGC)	Wild
IP12-3-6	Normal	Wild	Wild
IP12-3-9	Osteosarcoma	Wild	Wild
IP13-1-4	Osteosarcoma	Wild	Wild
IP13-2-2	Osteosarcoma	Wild	Wild
IP13-2-3	Osteosarcoma	Wild	Wild
IP13-3-10	Osteosarcoma	Not tested	Not tested
IP14-1-10	Osteoma	Not tested	Not tested
IP14-1-3	Osteosarcoma	Wild	Wild
IP14-2-3	Osteosarcoma	Wild	Wild
IP14-2-9	Osteosarcoma	Not tested	Not tested

### 4.3 Lymphoid Neoplasms from Mice

The following tables list up the selected specimens prepared for histopathological and immunohistochemical examinations of the lymphoid neoplasms obtained from the experiments for injections of  $^{239}\text{Pu}$  citrate solution or saline (Groups IP1 to IP 5 and IP7 to IP14), injections of MNU (MNU-1 to MNU-6), and whole-body  $\gamma$ -irradiation ( $\gamma$ -1 to  $\gamma$ -6) in three different strains of mice, respectively. These include the paraffin-embedded blocks, histological sections on glass slides stained with hematoxylin-eosin and others for immunohistochemistry, and MO disc files of microscopic pictures, respectively together with the information of individual animal case of lymphoid neoplasms.

#### 4.3.1 Paraffin-Blocks

The selected paraffin-blocks of lymphoid neoplasms from individual animals are put in a sealed plastic bag, stored in a bundle of the groups in the box. The following tables list the information of case number, mouse strain, injected dose of  $^{239}\text{Pu}$  or total dose of  $\gamma$ -ray, survival period, and histopathological diagnosis of lymphoid neoplasms of the individual animals as well as the number (#) of the container box.

#### Selected Paraffin-Blocks from the Control Groups of Pu-Injected Mice

Animal ID	Mouse Strain	IP Dose (Bq)	Post IP (day)	Histopathological Diagnosis Lymphoid Neoplasms	Box #
O-240-1	C3H	0	727	Thymic lymphoma(T-LBL)	9
O-240-5	"	"	817	Thymic lymphoma(T-LBL)	
O-242-3	"	"	756	Thymic lymphoma(T-LBL)	
O-242-7	"	"	848	Thymic lymphoma(T-LBL)	
O-242-8	"	"	893	Leukemic lymphoma(SLL)	
O-250-4	"	"	753	Lymphoma	
O-250-9	"	"	926	Histiocytic lymphoma	
O-256-5	"	"	807	Lymphoma(FCL)	
IP7-1-Ct1-4	C3H	0	755	Lymphoma(FCL)	9
IP7-2-Ct2-5	C57	"	789	Myeloid leukemia	
IP7-3-Ct1-6	BC3	"	769	Lymphoma(FCL)	
IP8-1-Ct1-8	C3H	"	882	Thymic lymphoma(T-LBL)	
IP8-2-Ct1-4	C57	"	667	Lymphoma(DLCL)	
IP8-2-Ct1-7	"	"	678	Myeloid leukemia	
IP8-2-Ct1-9	"	"	815	Lymphoma(FCL)	
IP8-2-Ct2-8	"	"	828	Thymic lymphoma(T-LBL)	
IP8-3-Ct1-1	BC3	"	529	Myeloid leukemia	
IP8-3-Ct1-3	"	"	724	Histiocytic lymphoma	
IP8-3-Ct1-5	"	"	739	Thymic lymphoma(T-LBL)	
IP8-3-Ct2-4	"	"	609	Lymphoma(SLL)	
IP8-3-Ct2-8	"	"	981	Lymphoma(FCL)	
IP9-1-Ct2-2	C3H	"	690	Lymphoma(FCL)	
IP9-2-Ct2-7	C57	"	719	Histiocytic lymphoma	
IP9-3-Ct1-4	BC3	"	597	Lymphoma(T-LBL)	
IP9-3-Ct2-1	"	"	560	Thymic lymphoma(T-LBL)	
IP9-3-Ct2-2	"	"	606	Myeloid leukemia	
IP9-3-Ct2-3	"	"	654	Myeloid leukemia	
IP9-3-Ct2-5	"	"	674	Thymic lymphoma(T-LBL)	
IP9-3-Ct2-8	"	"	791	Lymphoma(FCL)	
IP9-3-Ct2-9	"	"	798	Lymphoma(SLL)	
IP13-Ct-1	C57	0	441	Lymphoma(T-LBL)	10
IP13-Ct-2	"	"	527	Leukemic lymphoma(T-LBL)	
IP13-Ct-3	"	"	644	Lymphoma	
IP13-Ct-6	"	"	652	local. Lymphoma	
IP14-Ct-7	BC3	"	835	Myeloid leukemia	
IP14-Ct-8	"	"	838	Lymphoma(T-LBL)	

**Selected Paraffin-Blocks from the Groups of Pu-Injected Mice**

Animal ID	Mouse Strain	IP Dose (Bq)	Post IP (day)	Histopathological Diagnosis Lymphoid Neoplasms	Box #
IP1-1-1	C3H	10000	220	Leukemic lymphoma(SLL)	9
IP1-1-3	"	"	270	Histiocytic lymphoma	
IP1-2-6	"	5000	365	Lymphoma(SLL)	
IP1-2-7	"	"	365	Lymphoma(FCL)	
IP1-3-7	"	1000	461	Histiocytoma	
IP1-4-7	"	500	622	Lymphoma(DLCL)	
IP2-1-2	C3H	10000	330	Splenic lymphoma(MZL)	9
IP2-1-3	"	"	338	local. Lymphoma(?)	
IP2-2-1	"	5000	300	Lymphoma(SLL)	
IP2-2-3	"	"	330	Leukemia?	
IP3-1-1	C3H	10000	233	Leukemic lymphoma(SLL)	9
IP3-4-5	"	500	495	Myeloid leukemia	
IP4-1-3	C3H	10	626	Thymic lymphoma(T-LBL)	9
IP4-1-4	"	"	642	Lymphoma(SLL)	
IP4-2-10	"	"	881	Lymphoma(FCL)	
IP4-3-4	"	100	703	Histiocytic lymphoma	
IP4-3-6	"	"	795	Lymphoma(DLCL)	
IP4-3-7	"	"	809	Lymphoma(SLL)	
IP4-4-7	"	"	833	Myeloid leukemia	
IP5-1-5	C3H	10	819	Lymphoma(DLCL)	9
IP5-4-2	"	100	672	Splenic lymphoma(MZL)	
IP7-2-1-6	C57	100	740	Lymphoma(DLCL)	10
IP7-2-2-8	"	"	829	Thymic lymphoma(T-LBL)	
IP7-2-3-7	"	"	756	Thymic lymphoma(T-LBL)	
IP7-3-2-6	BC3	"	763	Lymphoma(FCL)	
IP7-3-1-10	"	"	979	Lymphoma(FCL)	
IP8-2-1-7	C57	500	681	Lymphoma(SLL)	10
IP8-2-1-8	"	"	682	Myeloid leukemia	
IP8-2-2-5	"	"	632	Lymphoma(DLCL)	
IP9-3-1-5	BC3	1000	397	Lymphoma(FCL)	10
IP10-2-1	C3H	5000	195	Leukemic lymphoma(SLL)	10
IP10-2-2	"	"	245	Lymphoma(SLL)	
IP10-3-1	"	"	160	Lymphoma(FCL)	
IP11-3-2-1	BC3	5000	215	Lymphoma(DLCL)	10
IP12-1-2	C3H	10000	225	Lymphoma(SLL)	10
IP12-2-1	"	"	222	Lymphoma(FCL)	
IP12-2-5	"	"	290	Lymphoma(DLCL)	
IP13-1-2	C57	10000	336	Lymphoma(DLCL)	10
IP13-2-4	"	"	416	Lymphoma(FCL)	
IP13-3-11	"	"	724	Lymphoma	
IP14-1-1	BC3	10000	202	Lymphoma(FCL)	10
IP14-1-2	"	"	291	Lymphoma(DLCL)	
IP14-2-2	"	"	386	Leukemic lymphoma(SLL)	

**Selected Paraffin-Blocks from the Groups of MNU-Injected Mice**

Animal ID	Mouse Strain	Post IP (day)	Histopathological Diagnosis Lymphoid Neoplasms	Box #
MNU-1-1-2	C3H	110	Thymic lymphoma(T-LBL)	11
MNU-1-2-1	"	87	Thymic lymphoma(T-LBL)	
MNU-1-2-3	"	106	Thymic lymphoma(T-LBL)	
MNU-1-3-4	"	75	Thymic lymphoma(T-LBL)	
MNU-1-3-5	"	80	Thymic lymphoma(T-LBL)	
MNU-1-3-6	"	85	Thymic lymphoma(T-LBL)	
MNU-1-3-7	"	87	Thymic lymphoma(T-LBL)	
MNU-1-3-8	"	95	Thymic lymphoma(T-LBL)	
MNU-1-3-9	"	115	Thymic lymphoma(T-LBL)	
MNU-1-3-10	"	119	Thymic lymphoma(T-SLL)	
MNU-1-3-11	"	120	Thymic lymphoma(T-LBL)	
MNU-2-1-4	C57	54	Thymic lymphoma(T-LBL)	11
MNU-2-3-1	"	45	Thymic lymphoma(T-LBL)	
MNU-2-3-2	"	54	Thymic lymphoma(T-SLL)	
MNU-2-3-3	"	55	Thymic lymphoma(T-LBL)	
MNU-2-3-5	"	64	Thymic lymphoma(T-LBL)	
MNU-2-3-7	"	70	Thymic lymphoma(T-SLL)	
MNU-2-3-9	"	81	Thymic lymphoma(T-LBL)	
MNU-3-1-1	BC3	31	Thymic lymphoma(T-LBL)	11
MNU-3-1-3	"	51	Thymic lymphoma(T-LBL)	
MNU-3-1-4	"	55	Thymic lymphoma(T-LBL)	
MNU-3-1-6	"	70	Thymic lymphoma(T-LBL)	
MNU-3-1-8	"	85	Thymic lymphoma(T-LBL)	
MNU-3-1-9	"	93	Lymphoma	
MNU-3-2-3	"	61	Thymic lymphoma(T-LBL)	
MNU-3-2-4	"	65	Thymic lymphoma(T-LBL)	
MNU-3-2-6	"	82	Lymphoma(T-LBL)	
MNU-3-2-8	"	102	Lymphoma	
MNU-3-2-9	"	104	Thymic lymphoma(T-LBL)	
MNU-3-2-10	"	130	Thymic lymphoma(T-LBL)	
MNU-3-3-1	"	39	Thymic lymphoma(T-SLL)	
MNU-3-3-2	"	48	Thymic lymphoma(T-LBL)	
MNU-3-3-4	"	67	Thymic lymphoma(T-LBL)	
MNU-3-3-5	"	79	Lymphoma	
MNU-3-3-10	"	104	Thymic lymphoma(T-LBL)	
MNU-4-1-1	C3H	37	Thymic lymphoma(T-LBL)	11
MNU-4-1-2	"	46	Thymic lymphoma(T-LBL)	
MNU-4-1-7	"	67	Thymic lymphoma(T-LBL)	
MNU-4-2-5	"	67	Thymic lymphoma(T-LBL)	
MNU-4-3-3	"	67	Lymphoma	
MNU-5-1-2	C57	34	Thymic lymphoma(T-LBL)	11
MNU-5-1-3	"	46	Thymic lymphoma(T-LBL)	
MNU-5-1-6	"	50	Thymic lymphoma(T-LBL)	
MNU-5-2-8	"	57	Thymic lymphoma(T-LBL)	
MNU-5-3-3	"	55	Thymic lymphoma(T-LBL)	
MNU-5-3-4	"	60	Thymic lymphoma(T-LBL)	
MNU-5-3-5	"	65	Thymic lymphoma(T-LBL)	
MNU-5-3-9	"	72	Thymic lymphoma(T-SLL)	
MNU-5-3-10	"	72	Thymic lymphoma(T-LBL)	
MNU-6-2-2	BC3	60	Lymphoma(T-LBL)	11
MNU-6-2-4	"	71	Lymphoma(T-LBL)	
MNU-6-2-6	"	74	Thymic lymphoma(T-LBL)	
MNU-6-3-5	"	97	Lymphoma(T-LBL)	
MNU-6-3-8	"	125	Lymphoma(T-LBL)	

### Selected Paraffin-Blocks from the Groups of $\gamma$ -Irradiated Mice

Animal ID	Mouse Strain	Dose (Gy)	Surv/Post $\gamma$ (day)	Histopathological Diagnosis Lymphoid Neoplasms	Box #
$\gamma$ -1-3-2-1	C3H	3	316/231	Leukemic lymphoma(B-Lym)	12
$\gamma$ -1-3-4-1	"	3	343/258	Lymphoma(T-Lym)	
$\gamma$ -1-3-3-1	"	3	523/438	meta.Osteosarcoma	
$\gamma$ -1-3-6-1	"	3	526/441	meta.Osteosarcoma	
$\gamma$ -1-Ct-2-1	"	0	636/(551)	Lymphoma(T-LBL)	
$\gamma$ -1-3-2-3	"	3	685/598	Lymphoma(PreB)	
$\gamma$ -2-3-1-1	C57	3	344/256	Lymphoma(T-Lym)	12
$\gamma$ -2-3-5-1	"	3	423/335	Lymphoma(T-LBL)	
$\gamma$ -2-3-2-2	"	3	546/458	Lymphoma(T-Lym)	
$\gamma$ -2-3-4-1	"	3	563/475	Lymphoma(T-LBL)	
$\gamma$ -2-2-3-3	"	2	632/544	Lymphoma(T-LBL)	
$\gamma$ -2-3-4-2	"	3	659/571	Leukemic lymphoma(T-LCL)	
$\gamma$ -2-2-1-2	"	2	673/585	Lymphoma(T-LCL)	
$\gamma$ -2-1-3-1	"	1	680/592	Histiocytic sarcoma	
$\gamma$ -2-Ct-2-2	"	0	689/(601)	Lymphoma	
$\gamma$ -2-2-3-4	"	2	770/682	Lymphoma(T-LBL)	
$\gamma$ -2-3-1-4	"	3	770/682	Lymphoma(T-LBL)	
$\gamma$ -2-1-1-1	"	1	788/700	Lymphoma(T-LCL)	
$\gamma$ -3-2-2-1	BC3	2	357/269	Lymphoma(T-LBL)	12
$\gamma$ -3-3-2-1	"	3	548/460	Leukemic lymphoma	
$\gamma$ -3-2-4-2	"	2	598/510	Lymphoma(Pre-B)	
$\gamma$ -3-1-1-3	"	1	672/584	Lymphoma(B-SLL)	
$\gamma$ -3-1-6-2	"	1	697/609	Lymphoma	
$\gamma$ -3-1-4-1	"	1	793/705	Lymphoma	
$\gamma$ -4-3-3-1	C3H	3	490/405	Lymphatic leukemia(LBL)	13
$\gamma$ -4-2-6-1	"	2	518/433	meta.Osteosarcoma	
$\gamma$ -4-1-1-1	"	1	622/537	Thymic lymphoma(T-LBL)	
$\gamma$ -4-1-4-1	"	1	664/579	Lymphoma(T-LBL)	
$\gamma$ -4-3-3-3	"	3	770/685	Lymphoma	
$\gamma$ -5-3-5-2	C57	3	408/320	Lymphoma(preB/LBL)	13
$\gamma$ -5-3-1-1	"	3	472/384	Myeloid leukemia	
$\gamma$ -5-Ct-1-1	"	0	526/(438)	Thymic lymphoma	
$\gamma$ -5-3-3-1	"	3	540/452	Leukemic lymphoma	
$\gamma$ -5-3-2-3	"	3	569/481	Lymphoma(Pre-B)	
$\gamma$ -5-2-6-1	"	2	575/487	Inflammatory response	
$\gamma$ -5-3-6-1	"	3	578/490	Myeloid neoplasm	
$\gamma$ -5-2-5-1	"	2	588/500	Lymphoma(T-LCL)	
$\gamma$ -5-1-1-2	"	1	599/511	Lymphoma	
$\gamma$ -5-2-6-2	"	2	640/552	Leukemic lymphoma(B-SLL)	
$\gamma$ -5-1-1-3	"	1	687/599	Lymphoma	
$\gamma$ -5-2-1-2	"	2	696/608	Lymphoma	
$\gamma$ -6-2-5-1	BC3	2	281/194	Lymphoma(T-LBL)	13
$\gamma$ -6-3-5-2	"	3	451/364	Lymphoma(T-Lym)	
$\gamma$ -6-2-4-1	"	2	512/425	Thymic lymphoma(T-LBL)	
$\gamma$ -6-1-1-1	"	1	527/440	Lymphoma	
$\gamma$ -6-1-4-1	"	1	581/494	Lymphocytic leukemia(B-SLL)	
$\gamma$ -6-2-5-2	"	2	722/635	Lymphoma	
$\gamma$ -6-2-3-2	"	3	751/664	Lymphoma(T-LBL)	

### 4.3.2 Histological Section Slides

The selected histological section slides of lymphoid neoplasms from individual animal case are put in a plastic box as indicated by the number. The following tables list the information of case number, mouse strain, injected dose of  $^{239}\text{Pu}$  or total dose of  $\gamma$ -ray, survival period, and histopathological diagnosis of lymphoid neoplasms of the individual animals as well as the number (#) of the slide box.

**Selected Section Slides from the Groups of Pu-Injected Mice**  
**(IP1 to IP5 & the Controls)**

Animal ID	Mouse Strain	IP Dose (Bq)	Post IP (day)	Histopathological Diagnosis Hematolymphoid Neoplasms	Box #
IP1-1-1	C3H	10000	220	Lymphatic leukemia(SLL)	PuIPLy 1
IP1-1-3	"	"	270	Histiocytic lymphoma	
IP3-1-1	"	"	233	Lymphatic leukemia(SLL)	
IP1-2-6	"	5000	365	Lymphoma(SLL)	
IP1-2-7	"	"	365	Lymphoma(FCL)	
IP2-2-1	C3H	5000	300	Lymphoma(SLL)	PuIPLy 2
IP2-1-2	"	10000	330	Splenic lymphoma(MZL)	
IP2-2-3	"	5000	330	Leukemia(?)	
IP2-1-3	"	10000	338	Local lymphoma(?)	
IP1-3-7	"	1000	461	Histiocytoma	
IP1-4-7	"	500	622	Lymphoma(DLCL)	
IP3-4-5	"	"	495	Myeloid leukemia	
IP4-1-3	"	10	626	Thymic lymphoma(T-LBL)	
IP4-1-3	C3H	10	626	Thymic lymphoma(T-LBL)	PuIPLy 3
IP4-1-4	"	"	642	Lymphoma(SLL)	
IP4-3-4	"	100	703	Histiocytic lymphoma	
IP5-4-2	"	"	672	Splenic lymphoma(MZL)	
IP4-3-6	"	"	795	Lymphoma(DLCL)	
IP4-3-7	"	"	809	Lymphoma(SLL)	
IP4-4-7	"	"	833	Myeloid leukemia	
IP4-4-7	C3H	100	833	Myeloid leukemia	PuIPLy 4
IP4-2-10	"	10	881	Lymphoma(FCL)	
IP5-1-5	"	"	819	Lymphoma(DLCL)	
O-240-1	"	0	727	Thymic lymphoma(T-LBL)	
O-240-5	"	"	817	Thymic lymphoma(T-LBL)	
O-242-3	"	"	756	Thymic lymphoma(T-LBL)	
O-242-7	"	"	848	Thymic lymphoma(T-LBL)	
O-242-8	"	"	893	Lymphatic leukemia(SLL)	
O-250-4	C3H	0	753	Lymphoma	PuIPLy 5
O-250-9	"	"	926	Histiocytic lymphoma	
O-256-5	"	"	807	Lymphoma(FCL)	

**Selected Section Slides from the Groups of Pu-Injected Mice  
(IP7 to IP14 & the Controls)**

Animal ID	Mouse Strain	IP Dose (Bq)	Post IP (day)	Histopathological Diagnosis Hematolymphoid Neoplasms	Box #
IP8-2-3-1	C57	500	237	Lymphoma	PuIP 1
IP8-2-1-1	C57	500	435	Lymphoma	
IP7-3-Ct1-3	BC3	0	595	Myeloid leukemia	PuIP 2
IP8-2-3-2	C57	500	442	Myeloid leukemia	
IP7-2-1-2	C57	100	659	Lymphoma	
IP7-3-2-3	BC3	100	659	Lymphoma	
IP8-3-2-1	BC3	500	465	Lymphoma	
IP7-3-1-5	BC3	100	696	Myeloid leukemia	PuIP 3
IP10-3-1	C3H	5000	160	Lymphoma	
IP8-3-1-5	BC3	500	507	Lymphoma	
IP8-3-2-2	BC3	500	519	Lymphoma	PuIP 4
IP8-3-Ct1-1	BC3	0	529	Myeloid leukemia	
IP7-2-1-6	C57	100	740	Lymphoma	PuIP 5
IP10-2-1	C3H	5000	195	Lymphoma	
IP9-2-2-6	C57	1000	371	Lymphoma	
IP7-1-Ct1-4	C3H	0	755	Lymphoma	
IP7-2-2-6	C57	100	754	Lymphoma	
IP7-2-3-7	C57	100	756	Thymic lymphoma	PuIP 6
IP7-3-2-6	BC3	100	763	Histiocytic lymphoma	
IP9-3-1-5	BC3	1000	397	Lymphoma	
IP7-3-Ct1-6	BC3	0	769	Lymphoma	
IP7-2-Ct2-5	C57	0	789	Myeloid leukemia	PuIP 7
IP10-2-2	C3H	5000	245	Lymphoma	
IP8-3-Ct2-4	BC3	0	609	Lymphoma	PuIP 8
IP7-2-2-8	C57	100	829	Thymic lymphoma	
IP8-2-1-5	C57	500	622	Lymphoma	PuIP 9
IP8-2-2-5	C57	500	632	Lymphoma	
IP8-2-Ct1-4	C57	0	667	Thymic lymphoma	PuIP 10
IP8-2-Ct1-7	C57	0	678	Myeloid leukemia	
IP8-2-1-7	C57	500	681	Lymphoma	PuIP 11
IP8-2-1-8	C57	500	682	Myeloid leukemia	
IP7-3-Ct2-8	BC3	0	899	Thymic lymphoma	
IP8-3-Ct1-3	BC3	0	724	Myeloid leukemia	
IP9-3-Ct2-1	BC3	0	560	Thymic lymphoma	
IP8-2-Ct2-4	C57	0	736	Thymic lymphoma	
IP9-3-2-11	BC3	1000	574	Myeloid leukemia	PuIP 12
IP8-3-Ct1-5	BC3	0	739	Thymic lymphoma	
IP11-3-2-1	BC3	5000	215	Myeloid leukemia	
IP8-3-Ct1-6	BC3	0	749	Lymphoma	
IP7-3-2-9	BC3	100	961	Lymphoma	
IP8-1-Ct2-4	C3H	0	755	Thymic lymphoma	
IP9-3-Ct1-4	BC3	0	597	Thymic lymphoma	
IP8-2-Ct1-8	C57	0	767	Lymphoma	PuIP 13
IP9-3-Ct2-2	BC3	0	606	Myeloid leukemia	
IP7-3-1-10	BC3	100	979	Lymphoma	
IP8-2-2-9	C57	500	795	Histiocytic lymphoma	
IP8-2-Ct1-9	C57	0	815	Lymphoma	
IP9-3-Ct2-3	BC3	0	654	Myeloid leukemia	
IP8-2-Ct2-8	C57	0	828	Thymic lymphoma	
IP9-3-Ct2-5	BC3	0	674	Thymic lymphoma	
IP9-1-Ct2-2	C3H	0	690	Lymphoma	PuIP 14
IP9-1-Ct1-6	C3H	0	709	Thymic lymphoma	
IP8-1-Ct1-8	C3H	0	882	Lymphoma	
IP9-2-Ct2-7	C57	0	719	Histiocytic lymphoma	

**Selected Section Slides from the Groups of Pu-Injected Mice**  
**(IP7 to IP14 & the Controls; Cont'd)**

Animal ID	Mouse Strain	IP Dose (Bq)	Post IP (day)	Histopathological Diagnosis Hematolymphoid Neoplasms	Box #
IP9-1-Ct2-6	C3H	0	781	Lymphoma	PuIP 15
IP9-3-Ct2-8	BC3	0	791	Lymphoma	
IP9-3-Ct1-7	BC3	0	794	Lymphoma	
IP9-3-Ct2-9	BC3	0	798	Lymphoma	PuIP 16
IP8-3-Ct2-8	BC3	0	981	Lymphoma	
IP8-3-Ct1-9	BC3	0	994	Lymphoma	
IP12-2-1	C3H	10000	222	Lymphoma	PuIP 17
IP12-1-2	C3H	10000	225	Lymphoma	
IP12-2-5	C3H	10000	290	Lymphoma	
IP14-1-1	BC3	10000	202	Lymphoma	PuIP 18
IP13-1-2	C57	10000	336	Lymphoma	
IP14-1-2	BC3	10000	291	Lymphoma	PuIP 19
IP13-2-4	C57	10000	416	Lymphoma	
IP13-2-4	C57	10000	416	Lymphoma	PuIP 20
IP13-Ct-1	C57	0	441	Lymphoma	
IP14-2-2	BC3	10000	386	Lymphoma	PuIP 21
IP13-Ct-2	C57	0	527	Lymphoma	
IP13-Ct-3	C57	0	644	Lymphoma	
IP13-Ct-3	C57	0	644	Lymphoma	PuIP 22
IP13-Ct-6	C57	0	652	Lymphoma	
IP13-3-11	C57	10000	724	Lymphoma	
IP14-Ct-7	BC3	0	835	Myeloid leukemia	
IP14-Ct-8	BC3	0	838	Lymphoma	PuIP 23

**Selected Section Slides from the Groups of MNU-Injected Mice**

Animal ID	Mouse Strain	Post IP (day)	Histopathological Diagnosis Lymphoid Neoplasms	Box #
MNU-1-3-4	C3H	75	Thymic lymphoma(T-LBL)	MNU 1
MNU-1-3-5	C3H	80	Thymic lymphoma(T-LBL)	
MNU-1-3-6	C3H	85	Thymic lymphoma(T-LBL)	
MNU-1-2-1	C3H	87	Thymic lymphoma(T-LBL)	MNU 2
MNU-1-3-7	C3H	87	Thymic lymphoma(T-LBL)	
MNU-1-3-8	C3H	95	Thymic lymphoma(T-LBL)	
MNU-1-2-3	C3H	106	Thymic lymphoma(T-LBL)	
MNU-1-1-2	C3H	110	Thymic lymphoma(T-LBL)	MNU 3
MNU-1-3-9	C3H	115	Thymic lymphoma(T-LBL)	
MNU-1-3-10	C3H	119	Thymic lymphoma(T-SLL)	
MNU-1-3-11	C3H	120	Thymic lymphoma(T-LBL)	
MNU-2-3-1	C57	45	Thymic lymphoma(T-LBL)	MNU 4
MNU-2-3-2	C57	54	Thymic lymphoma(T-SLL)	
MNU-2-1-4	C57	54	Thymic lymphoma(T-LBL)	
MNU-2-3-3	C57	55	Thymic lymphoma(T-LBL)	
MNU-2-3-5	C57	64	Thymic lymphoma(T-LBL)	MNU 5
MNU-2-3-7	C57	70	Thymic lymphoma(T-SLL)	
MNU-3-1-1	BC3	31	Thymic lymphoma(T-LBL)	
MNU-2-3-9	C57	81	Thymic lymphoma(T-LBL)	
MNU-3-3-1	BC3	39	Thymic lymphoma(T-SLL)	
MNU-3-3-2	BC3	48	Thymic lymphoma(T-LBL)	



**Selected Section Slides from the Groups of MNU-Injected Mice (Cont'd)**

Animal ID	Mouse Strain	Post IP (day)	Histopathological Diagnosis Lymphoid Neoplasms	Box #
MNU-3-3-2	BC3	48	Thymic lymphoma(T-LBL)	MNU 6
MNU-3-1-3	BC3	51	Thymic lymphoma(T-LBL)	
MNU-3-1-4	BC3	55	Thymic lymphoma(T-LBL)	
MNU-3-2-3	BC3	61	Thymic lymphoma(T-LBL)	
MNU-3-2-4	BC3	65	Thymic lymphoma(T-LBL)	
MNU-3-3-4	BC3	67	Thymic lymphoma(T-LBL)	MNU 7
MNU-3-1-6	BC3	70	Thymic lymphoma(T-LBL)	
MNU-3-3-5	BC3	79	Lymphoma	
MNU-3-2-6	BC3	82	Lymphoma(T-LBL)	
MNU-3-1-8	BC3	85	Thymic lymphoma(T-LBL)	MNU 8
MNU-3-1-9	BC3	93	Lymphoma	
MNU-3-2-9	BC3	104	Thymic lymphoma(T-LBL)	
MNU-3-3-10	BC3	104	Thymic lymphoma(T-LBL)	
MNU-3-2-8	BC3	102	Lymphoma	
MNU-3-2-8	BC3	102	Lymphoma	MNU 9
MNU-3-2-10	BC3	130	Thymic lymphoma(T-LBL)	
MNU-4-1-1	C3H	37	Thymic lymphoma(T-LBL)	
MNU-4-1-2	C3H	46	Thymic lymphoma(T-LBL)	
MNU-4-1-7	C3H	67	Thymic lymphoma(T-LBL)	
MNU-4-2-5	C3H	67	Thymic lymphoma(T-LBL)	
MNU-4-2-5	C3H	67	Lymphoma	MNU 10
MNU-4-3-3	C3H	67	Lymphoma	
MNU-5-1-2	C57	34	Thymic lymphoma(T-LBL)	
MNU-5-1-3	C57	46	Thymic lymphoma(T-LBL)	
MNU-5-1-6	C57	50	Thymic lymphoma(T-LBL)	
MNU-5-3-3	C57	55	Thymic lymphoma(T-LBL)	MNU 11
MNU-5-2-8	C57	57	Thymic lymphoma(T-LBL)	
MNU-5-3-4	C57	60	Thymic lymphoma(T-LBL)	
MNU-5-3-5	C57	65	Thymic lymphoma(T-LBL)	
MNU-5-3-5	C57	65	Thymic lymphoma(T-LBL)	MNU 12
MNU-5-3-9	C57	72	Thymic lymphoma(T-SLL)	
MNU-5-3-10	C57	72	Thymic lymphoma(T-LBL)	
MNU-6-2-2	BC3	60	Lymphoma(T-LBL)	
MNU-6-2-2	BC3	60	Lymphoma(T-LBL)	MNU 13
MNU-6-2-4	BC3	71	Lymphoma(T-LBL)	
MNU-6-2-6	BC3	74	Thymic lymphoma(T-LBL)	
MNU-6-3-5	BC3	97	Lymphoma(T-LBL)	
MNU-6-3-5	BC3	97	Lymphoma(T-LBL)	MNU 14
MNU-6-3-8	BC3	125	Lymphoma(T-LBL)	

**Selected Section Slides from the Groups of  $\gamma$ -Irradiated Mice**

Animal ID	Mouse Strain	Dose (Gy)	Surv/Post $\gamma$ (day)	Histopathological Diagnosis Hematolymphoid Neoplasms	Box #
$\gamma$ -1-3-2-1	C3H	3	316/231	Leukemic lymphoma(B-Lym)	$\gamma$ HL 1
$\gamma$ -2-3-1-1	C57	3	344/256	Lymphoma(T-Lym)	
$\gamma$ -1-3-4-1	C3H	3	343/258	Lymphoma(T-Lym)	
$\gamma$ -6-2-5-1	BC3	2	281/194	Lymphoma(T-Lym)	
$\gamma$ -3-2-2-1	BC3	2	357/269	Lymphoma(T-Lym)	$\gamma$ HL 2
$\gamma$ -2-3-5-1	C57	2	423/335	Lymphoma(T-Lym)	
$\gamma$ -5-3-5-2	C57	3	408/320	Lymphoma	
$\gamma$ -4-3-3-1	C3H	3	490/405	Lymphatic leukemia(LBL)	
$\gamma$ -5-3-1-1	C57	3	472/384	Myeloid leukemia	
$\gamma$ -1-3-3-1	C3H	3	523/438	meta.Osteosarcoma	$\gamma$ HL 3
$\gamma$ -1-3-6-1	C3H	3	526/441	meta.Osteosarcoma	
$\gamma$ -2-3-2-2	C57	3	546/458	Lymphoma(T-Lym)	
$\gamma$ -6-3-5-2	BC3	3	451/364	Lymphoma(T-Lym)	
$\gamma$ -4-2-6-1	C3H	2	518/433	meta.Osteosarcoma	
$\gamma$ -2-3-4-1	C57	3	563/475	Lymphoma(T-LBL)	$\gamma$ HL 4
$\gamma$ -3-3-2-1	BC3	3	548/460	Leukemic lymphoma	
$\gamma$ -5-Ct-1-1	C57	0	526/(438)	Thymic lymphoma	
$\gamma$ -5-3-3-1	C57	3	540/452	Leukemic lymphoma	
$\gamma$ -5-3-3-1	C57	3	540/452	Leukemic lymphoma	$\gamma$ HL 5
$\gamma$ -6-2-4-1	BC3	2	512/425	Thymic lymphoma(T-LBL)	
$\gamma$ -6-1-1-1	BC3	1	527/440	Lymphoma	
$\gamma$ -2-2-3-3	C57	2	632/544	Lymphoma(T-LBL)	
$\gamma$ -3-2-4-2	BC3	2	598/510	Lymphoma(Pre-B)	$\gamma$ HL 6
$\gamma$ -5-3-2-3	C57	3	569/481	Lymphoma(Pre-B)	
$\gamma$ -5-2-6-1	C57	2	575/487	Inflammatory response	
$\gamma$ -5-3-6-1	C57	3	578/490	Myeloid neoplasm	
$\gamma$ -5-2-5-1	C57	2	588/500	Lymphoma(T-LCL)	
$\gamma$ -1-Ct-2-1	C3H	0	636/(551)	Lymphoma(T-LBL)	$\gamma$ HL 7
$\gamma$ -2-3-4-2	C57	3	659/571	Leukemic lymphoma(T-LCL)	
$\gamma$ -4-1-1-1	C3H	1	622/537	Thymic lymphoma(T-LBL)	
$\gamma$ -5-1-1-2	C57	1	599/511	Lymphoma	
$\gamma$ -2-2-1-2	C57	2	673/585	Lymphoma(T-LCL)	$\gamma$ HL 8
$\gamma$ -2-1-3-1	C57	1	680/592	Histiocytic sarcoma	
$\gamma$ -6-1-4-1	BC3	1	581/494	Lymphocytic leukemia(B-SLL)	
$\gamma$ -2-Ct-2-2	C57	0	689/(601)	Lymphoma	
$\gamma$ -1-3-2-3	C3H	3	685/600	Lymphoma(PreB)	$\gamma$ HL 9
$\gamma$ -4-1-4-1	C3H	1	664/579	Lymphoma(T-LBL)	
$\gamma$ -5-2-6-2	C57	2	640/552	Leukemic lymphoma(B-SLL)	
$\gamma$ -3-1-1-3	BC3	1	672/584	Lymphoma(B-SLL)	
$\gamma$ -3-1-6-2	BC3	1	697/609	Lymphoma	$\gamma$ HL 10
$\gamma$ -5-1-1-3	C57	1	687/599	Lymphoma	
$\gamma$ -5-2-1-2	C57	2	696/608	Lymphoma	
$\gamma$ -2-2-3-4	C57	2	770/682	Lymphoma(T-LBL)	
$\gamma$ -2-2-3-4	C57	2	770/682	Lymphoma(T-LBL)	$\gamma$ HL 11
$\gamma$ -2-3-1-4	C57	3	770/682	Lymphoma(T-LBL)	
$\gamma$ -2-1-1-1	C57	1	788/700	Lymphoma(T-LCL)	
$\gamma$ -4-3-3-3	C3H	3	770/685	Lymphoma	
$\gamma$ -6-2-5-2	BC3	2	722/635	Lymphoma	
$\gamma$ -3-1-4-1	BC3	1	793/705	Lymphoma	$\gamma$ HL 12
$\gamma$ -6-2-3-2	BC3	2	751/664	Lymphoma(T-LBL)	

### 4.3.3 Digital Pictures

The selected microscopic pictures of lymphoid neoplasms from individual animals are saved as digital pictures in the folder of the MO disc files as indicated. The following tables list the information of the file name, object, staining, power magnification, histopathological diagnosis of lymphoid neoplasms, as well as the strain, injected dose of  $^{239}\text{Pu}$  or total dose of  $\gamma$ -ray and survival period of the individual animals, in each MO disc file.

**Selected Digital Pictures from the Groups of Pu-Injected Mice**  
**MO: DATA 3-1**

Folder: PuIP/Lymphoma1								
No.	File Name	Object	Stain	P.Mag.	Diagnosis(REAL)	Strain	Dose	Day
1	IP4-3-6/Liv/HE	Liver	HE	x100	Lymphoma(DLCL)	C3H	100	795
2	IP4-3-6/Liv/B220	Liver	B220	x100				
3	IP4-3-6/Liv/CD5	Liver	CD5	x100				
4	IP4-3-6/Sp/HE	Spleen	HE	x100				
5	IP4-3-7/Liv/HE	Liver	HE	x100	Lymphoma(SLL)	C3H	100	809
6	IP4-3-7/Liv/B220	Liver	B220	x100				
7	IP4-3-7/Sp/HE	Spleen	HE	x100				
8	IP4-3-7/Sp/B220	Spleen	B220	x100				
9	IP4-4-7/Liv/HE	Liver	HE	x100	Myeloid Leukemia	C3H	100	833
10	IP4-4-7/Liv/B220	Liver	B220	x100				
11	IP4-4-7/Liv2/HE	Liver	HE	x400				
12	IP4-4-7/Liv2/B220	Liver	B220	x400				
13	IP4-4-7/Sp/HE	Spleen	HE	x100				
14	IP4-4-7/Sp/B220	Spleen	B220	x100				
15	IP5-1-5/Liv/HE	Liver	HE	x100	Lymphoma(DLCL)	C3H	10	819
16	IP5-1-5/Liv/B220	Liver	B220	x100				
17	IP10-4-1/Liv/HE	Liver	HE	x100	Lymphatic Leukemia(FCL)	C3H	5000	160
18	IP10-4-1/Sp/HE	Spleen	HE	x100				
19	IP10-4-1/LN/HE	LN	HE	x100				
20	IP7-2-1-6/Liv/HE	Liver	HE	x100	Lymphoma(DLCL)	C57	100	740
21	IP7-2-1-6/Sp/HE	Spleen	HE	x100				
22	IP7-2-1-6/Kid/HE	Kidney	HE	x100				
23	IP7-2-1-6/LN/HE	LN	HE	x100				
24	IP10-2-1/Liv/HE	Liver	HE	x100	Lymphatic Leukemia(SLL)	C3H	5000	195
25	IP10-2-1/Sp/HE	Spleen	HE	x100				
26	IP10-2-1/Sp2/HE	Spleen	HE	x100				
27	IP7-2-3-7/Liv/HE	Liver	HE	x100	Thymic Lymphoma(T-LBL)	C57	100	756
28	IP7-2-3-7/Liv/CD3	Liver	CD3	x100				
29	IP7-2-3-7/LN/HE	LN	HE	x100				
30	IP7-2-3-7/LN/CD3	LN	CD3	x100				
31	IP7-2-3-7/LN2/HE	LN	HE	x100				
32	IP7-2-3-7/LN2/CD3	LN	CD3	x100				
33	IP7-3-2-6/Liv/HE	Liver	HE	x100	Lymphoma(FCL)	BC3	100	763
34	IP7-3-2-6/Liv2/HE	Liver	HE	x100				
35	IP7-3-2-6/Sp/HE	Spleen	HE	x100				
36	IP7-3-2-6/Sp2/HE	Spleen	HE	x100				
37	IP7-3-2-6/Kid/HE	Kidney	HE	x100				
38	IP7-3-2-6/Kid2/HE	Kidney	HE	x100				

**Selected Digital Pictures from the Groups of Pu-Injected Mice**  
**MO: DATA 3-1(Cont'd)**

Folder: PuIP/Lymphoma2								
No.	File Name	Object	Stain	P.Mag.	Diagnosis(REAL)	Strain	Dose	Day
1	IP9-3-1-5/Liv/HE	Liver	HE	x100	Lymphatic Leukemia(FCL)	BC3	1000	397
2	IP9-3-1-5/Liv/B220	Liver	B220	x100				
3	IP9-3-1-5/Liv2/B220	Liver	B220	x100				
4	IP9-3-1-5/Sp/HE	Spleen	HE	x100				
5	IP9-3-1-5/Sp/B220	Spleen	B220	x100				
6	IP9-3-1-5/Sp2/B220	Spleen	B220	x100				
7	IP9-3-1-5/LN/HE	LN <sub>s</sub>	HE	x100	Lymphoma(SLL)	C57	500	681
8	IP9-3-1-5/LN2/HE	LN <sub>s</sub>	HE	x100				
9	IP8-2-1-7/Liv/HE	Liver	HE	x100				
10	IP8-2-1-7/Liv/CD5	Liver	CD5	x100				
11	IP8-2-1-7/Liv2/HE	Liver	HE	x100				
12	IP8-2-1-7/Liv2/CD5	Liver	CD5	x100				
13	IP8-2-1-7/Sp/HE	Spleen	HE	x100	Lymphoma(DLCL)	BC3	5000	215
14	IP8-2-1-7/Sp/CD5	Spleen	CD5	x100				
15	IP8-2-1-7/Sp2/CD5	Spleen	CD5	x100				
16	IP8-2-1-7/SP3/CD5	Spleen	CD5	x100				
17	IP11-3-2-1/Liv/HE	Liver	HE	x100				
18	IP11-3-2-1/Liv2/HE	Liver	HE	x100				
19	IP11-3-2-1/Sp/HE	Spleen	HE	x100	Lymphoma(SLL) Thymic Lymphoma(T-LBL)	C3H C57	5000 100	245 829
20	IP10-2-2/Liv/HE	Liver	HE	x100				
21	IP7-2-2-8/Liv/HE	Liver	HE	x100				
22	IP7-2-2-8/Liv/CD3	Liver	CD3	x100				
23	IP7-2-2-8/Liv2/HE	Liver	HE	x100				
24	IP7-2-2-8/Liv2/CD3	Liver	CD3	x100				
25	IP12-2-1/LN/HE	LN <sub>s</sub>	HE	x100	Lymphoma(FCL)	C3H	10000	222
26	IP12-1-2/Liv/HE	Liver	HE	x200	Lymphoma(SLL)	C3H	10000	225
27	IP12-1-2/Liv/B220	Liver	B220	x200	Lymphoma(DLCL)	C3H	10000	290
28	IP12-1-2/Sp/HE	Spleen	HE	x200				
29	IP12-1-2/Sp/B220	Spleen	B220	x200				
30	IP12-2-5/Liv/HE	Liver	HE	x200				
31	IP12-2-5/Sp/HE	Spleen	HE	x200				
32	IP12-2-5Kid/HE	Kidney	HE	x100				
33	IP12-2-5/LN/HE	LN <sub>s</sub>	HE	x200				
34	IP12-2-5LN/B220	LN <sub>s</sub>	B220	x200				
35	IP12-2-5/LN2/HE	LN <sub>s</sub>	HE	x200				
36	IP12-2-5/LN2/B220	LN <sub>s</sub>	B220	x200				

**Selected Digital Pictures from the Groups of Pu-Injected Mice**  
**MO: DATA 3-1(Cont'd)**

Folder: PuIP/Lymphoma3								
No.	File Name	Object	Stain	P.Mag.	Diagnosis(REAL)	Strain	Dose	Day
1	IP14-1-1/Liv/HE	Liver	HE	x100	Lymphoma(FCL)	BC3	10000	202
2	IP14-1-1/Liv2/HE	Liver	HE	x200				
3	IP14-1-1/Liv3/HE	Liver	HE	x100				
4	IP14-1-1/Liv4/HE	Liver	HE	x200				
5	IP14-1-1/Sp/HE	Spleen	HE	x100				
6	IP14-1-1/Sp2/HE	Spleen	HE	x200				
7	IP14-1-1/Sp3/HE	Spleen	HE	x100				
8	IP14-1-1/Sp4/HE	Spleen	HE	x200				
9	IP13-1-2/Liv/HE	Liver	HE	x200	Lymphoma(DLCL)	C57	10000	336
10	IP13-1-2/Liv/CD5	Liver	CD5	x200				
11	IP13-1-2/Liv/CD3	Liver	CD3	x200				
12	IP13-1-2/Sp/HE	Spleen	HE	x200	Lymphoma(DLCL)	BC3	10000	291
13	IP14-1-2/Liv/HE	Liver	HE	x200				
14	IP14-1-2/Liv2/HE	Liver	HE	x200				
15	IP13-2-4/Liv/HE	Liver	HE	x200	Lymphoma(FCL)	C57	10000	416
16	IP13-2-4/Liv/B220	Liver	B220	x200				
17	IP13-2-4/Liv/CD5	Liver	CD5	x200				
18	IP13-2-4/Sp/HE	Spleen	HE	x100				
19	IP13-2-4/Sp/B220	Spleen	B220	x100				
20	IP13-2-4/Sp2/HE	Spleen	HE	x200				
21	IP13-2-4/Sp2/B220	Spleen	B220	x200				

**Selected Digital Pictures from the Control Groups of Pu-Injected Mice**  
**MO: DATA3-2**

Folder: Pu Control/Lymphoma1								
No.	File Name	Object	Stain	P.Mag.	Diagnosis(REAL)	Strain	Dose	Day
1	O-240-1/Thy/HE	Thymus	HE	x200	Thymic Lymphoma(T-LBL)	C3H	0	727
2	O-240-1/Thy/B220	Thymus	B220	x200				
3	O-240-1/Thy/CD3	Thymus	CD3	x200				
4	O-240-1/Sp/HE	Spleen	HE	x200				
5	O-240-1/Sp/B220	Spleen	B220	x200				
6	O-240-1/Sp/CD3	Spleen	CD3	x200				
7	O-240-1/LN/HE	LN	HE	x200	Thymic Lymphoma(T-LBL)	C3H	0	817
8	O-240-1/LN/B220	LN	B220	x200				
9	O-240-1/LN/CD3	LN	CD3	x200				
10	O-240-5/LN/HE	LN	HE	x200				
11	O-240-5/LN/B220	LN	B220	x200				
12	O-240-5/LN/CD3	LN	CD3	x200				
13	O-242-7/Thy/HE	Thymus	HE	x200	Thymic Lymphoma(T-LBL)	C3H	0	848
14	O-242-7/Thy/Thy1	Thymus	Thy1	x200				
15	O-242-7/Thy/CD3	Thymus	CD3	x200				
16	O-242-8/Sp/HE	Spleen	HE	x200	Lymphoma(SLL)	C3H	0	893
17	O-242-8/Sp/B220	Spleen	B220	x200				
18	O-242-8/LN/HE	LN	HE	x200				
19	O-242-8/LN/B220	LN	B220	x200	Lymphoma(FCL)	C3H	0	755
20	IP7-1-Ct1-4/Liv/HE	Liver	HE	x100				
21	IP7-1-Ct1-4/Liv/CD3	Liver	CD3	x100				
22	IP7-1-Ct1-4/Sp/HE	Spleen	HE	x200	Lymphoma(SLL)	BC3	0	609
23	IP7-1-Ct1-4/Sp/CD3	Spleen	CD3	x200				
24	IP8-3-Ct2-4/Liv/HE	Liver	HE	x100				
25	IP8-3-Ct2-4/Liv2/HE	Liver	HE	x200				
26	IP8-3-Ct2-4/Sp/HE	Spleen	HE	x100				
27	IP8-3-Ct2-4/Sp2/HE	Spleen	HE	x200				
28	IP8-3-Ct2-4/LN/HE	LN	HE	x100	Histiocytic Lymphoma	BC3	0	724
29	IP8-3-Ct2-4/LN2/HE	LN	HE	x200				
30	IP8-3-Ct1-3/Liv/HE	Liver	HE	x100				
31	IP8-3-Ct1-3/Liv2/HE	Liver	HE	x200				
32	IP8-3-Ct1-3/Sp/HE	Spleen	HE	x100				
33	IP8-3-Ct1-3/Sp2/HE	Spleen	HE	x200				

**Selected Digital Pictures from the Control Groups of Pu-Injected Mice**  
**MO: DATA3-2 (Cont'd)**

Folder: Pu Control/Lymphoma2								
No.	File Name	Object	Stain	P.Mag.	Diagnosis(REAL)	Strain	Dose	Day
1	IP8-3-Ct1-5/Liv/HE	Liver	HE	x200	Thymic Lymphoma(T-LBL)	BC3	0	739
2	IP8-3-Ct1-5/Liv/CD3	Liver	CD3	x200				
3	IP8-3-Ct1-5/Sp/HE	Spleen	HE	x200				
4	IP8-3-Ct1-5/Sp/CD3	Spleen	CD3	x200				
5	IP8-3-Ct1-5/LN/HE	LN	HE	x200				
6	IP8-3-Ct1-5/LN/CD3	LN	CD3	x200	Lymphoma(T-LBL)	BC3	0	597
7	IP9-3-Ct1-4/Liv/HE	Liver	HE	x200				
8	IP9-3-Ct1-4/Liv/CD5	Liver	CD5	x200				
9	IP9-3-Ct1-4/Sp/HE	Spleen	HE	x200				
10	IP9-3-Ct1-4/Sp/CD5	Spleen	CD5	x200				
11	IP9-3-Ct2-2/Liv/HE	Liver	HE	x200	Myeloid Leukemia	BC3	0	606
12	IP9-3-Ct2-2/Sp/HE	Spleen	HE	x200				
13	IP8-2-Ct1-9/Liv/HE	Liver	HE	x100	Lymphoma(FCL)	C57	0	815
14	IP8-2-Ct1-9/Liv/CD3	Liver	CD3	x100				
15	IP8-2-Ct1-9/Liv2/HE	Liver	HE	x200				
16	IP8-2-Ct1-9/Liv2/CD3	Liver	CD3	x200				
17	IP8-2-Ct1-9/Sp/HE	Spleen	HE	x100				
18	IP8-2-Ct1-9/Sp/CD3	Spleen	CD3	x100				
19	IP8-2-Ct1-9/Sp2/HE	Spleen	HE	x200				
20	IP8-2-Ct1-9/Sp2/CD3	Spleen	CD3	x200				
21	IP8-2-Ct1-9/LN/HE	LN	HE	x100				
22	IP8-2-Ct1-9/LN/CD3	LN	CD3	x100				
23	IP8-2-Ct1-9/LN2/HE	LN	HE	x200				
24	IP8-2-Ct1-9/LN2/CD3	LN	CD3	x200				
25	IP8-1-Ct1-8/Liv/HE	Liver	HE	x200	Lymphoma(T-LBL)	C3H	0	882
26	IP8-1-Ct1-8/Liv/CD3	Liver	CD3	x200				
27	IP8-1-Ct1-8/Sp/HE	Spleen	HE	x200	Lymphoma(FCL)	BC3	0	791
28	IP8-1-Ct1-8/Sp/CD3	Spleen	CD3	x200				
29	IP9-3-Ct2-8/Liv/HE	Liver	HE	x200				
30	IP9-3-Ct2-8/Liv/Thy1	Liver	Thy1	x200				
31	IP9-3-Ct2-8/Liv/CD3	Liver	CD3	x200				
32	IP9-3-Ct2-8/Sp/HE	Spleen	HE	x200				
33	IP9-3-Ct2-8/Sp/Thy1	Spleen	Thy1	x200				
34	IP9-3-Ct2-8/Sp/CD3	Spleen	CD3	x200				

**Selected Digital Pictures from the Control Groups of Pu-Injected Mice**  
**MO: DATA3-2 (Cont'd)**

Folder: Pu Control/Lymphoma3								
No.	File Name	Object	Stain	P.Mag.	Diagnosis(REAL)	Strain	Dose	Day
1	IP9-3-Ct2-9/Liv/HE	Liver	HE	x200	Lymphoma(SLL)	BC3	0	798
2	IP9-3-Ct2-9/Liv/B220	Liver	B220	x200				
3	IP9-3-Ct2-9/Sp/HE	Spleen	HE	x200				
4	IP9-3-Ct2-9/Sp/B220	Spleen	B220	x200				
5	IP9-3-Ct2-9/LN/HE	LN	HE	x200				
6	IP9-3-Ct2-9/LN/B220	LN	B220	x200				
7	IP8-3-Ct2-8/Liv/HE	Liver	HE	x200	Lymphoma(FCL)	BC3	0	981
8	IP8-3-Ct2-8/Liv2/HE	Liver	HE	x200				
9	IP8-3-Ct2-8/Liv/CD3	Liver	CD3	x200				
10	IP8-3-Ct2-8/Liv2/CD3	Liver	CD3	x200				
11	IP8-3-Ct2-8/Sp/HE	Spleen	HE	x200				
12	IP8-3-Ct2-8/LN/HE	LN	HE	x200				
13	IP8-3-Ct2-8/Sp/CD3	Spleen	CD3	x200	Lymphoma(FCL)	C57	0	644
14	IP8-3-Ct2-8/LN/CD3	LN	CD3	x200				
15	IP8-3-Ct2-8/Kid/HE	Kidney	HE	x200				
16	IP8-3-Ct2-8/Kid/CD3	Kidney	CD3	x200				
17	IP13-Ct-3/Sp1/HE	Spleen	HE	x200				
18	IP13-Ct-3/Sp1/B220	"	B220	"	Histiocytic Sarcoma	C57	0	652
19	IP13-Ct-3/Sp1/CD5	"	CD5	"				
20	IP13-Ct-3/Sp1/CD19	"	CD19	"				
21	IP13-Ct-3/Sp2/HE	Spleen	HE	x200				
22	IP13-Ct-3/Sp2/B220	"	B220	"				
23	IP13-Ct-3/Sp2/CD5	"	CD5	"				
24	IP13-Ct-3/Sp2/CD19	"	CD19	"	Myeloid Leukemia	BC3	0	835
25	IP13-Ct-3/LN/HE	LN	HE	x200				
26	IP13-Ct-3/LN/CD5	"	CD5	"				
27	IP13-Ct-3/LN/CD19	"	CD19	"				
28	IP13-Ct-3/LN/CD19-2	"	"	"				
29	IP13-Ct-6/Liv1/HE	Liver	HE	x200	Lymphoma(T-LBL)	BC3	0	838
30	IP13-Ct-6/Liv2/HE	"	"	"				
31	IP13-Ct-6/Liv3/HE	"	"	"				
32	IP13-Ct-6/LN1/HE	LN	"	"				
33	IP13-Ct-6/LN2/HE	"	"	"				
34	IP13-Ct-6/LN3/HE	"	"	"				
35	IP13-Ct-6/LN4/Aml	"	"	"	Lymphoma(T-LBL)	BC3	0	838
36	IP13-Ct-6/LN5/HE	"	"	"				
37	IP14-Ct-7/Liv1/HE	Liver	HE	x200				
38	IP14-Ct-7/Liv2/HE	"	"	x400				
39	IP14-Ct-7/Sp1/HE	Spleen	"	x200				
40	IP14-Ct-7/Sp2/HE	"	"	x400				
41	IP14-Ct-8/Sp/HE	Spleen	HE	x200	Lymphoma(T-LBL)	BC3	0	838
42	IP14-Ct-8/Sp/CD3	"	CD3	x200				
43	IP14-Ct-8/LN1/HE	LN	HE	x200				
44	IP14-Ct-8/LN2/HE	"	"	x200				



**Selected Digital Pictures from the Groups of MNU-Injected Mice**  
**MO: DATA3-3**

Folder: MNU/Lymphoma1								
No.	File Name	Object	Stain	P.Mag.	Diagnosis(REAL)	Strain	Dose	Day
1	MNU-3-3-2/Liv/HE	Liver	HE	x200	Thymic Lymphoma(T-LBL)	BC3		48
2	MNU-3-3-2/Liv/CD3	Liver	CD3	x200				
3	MNU-3-3-2/Sp/HE	Spleen	HE	x100				
4	MNU-3-3-2/Sp/CD3	Spleen	CD3	x100				
5	MNU-3-3-2/Thy/HE	Thymus	HE	x200				
6	MNU-3-3-2/Thy/CD3	Thymus	CD3	x200	Thymic Lymphoma(T-LBL)	BC3		61
7	MNU-3-2-3/Liv/HE	Liver	HE	x200				
8	MNU-3-2-3/Liv/CD3	Liver	CD3	x200				
9	MNU-3-2-3/Sp/HE	Spleen	HE	x200				
10	MNU-3-2-3/Sp/CD3	Spleen	CD3	x200				
11	MNU-3-2-3/Thy/HE	Thymus	HE	x200	Thymic Lymphoma(T-LBL)	BC3		65
12	MNU-3-2-4/Liv/HE	Liver	HE	x200				
13	MNU-3-2-4/Liv/CD3	Liver	CD3	x200				
14	MNU-3-2-4/Sp/HE	Spleen	HE	x100				
15	MNU-3-2-4/Sp/CD3	Spleen	CD3	x100				
16	MNU-3-2-4/Thy/HE	Thymus	HE	x200	Thymic Lymphoma(T-LBL)	BC3		70
17	MNU-3-1-6/Liv/HE	Liver	HE	x200				
18	MNU-3-1-6/Liv/CD3	Liver	CD3	x200				
19	MNU-3-1-6/Sp/HE	Spleen	HE	x200				
20	MNU-3-1-6/Sp/CD3	Spleen	CD3	x200				
21	MNU-3-1-6/Thy/HE	Thymus	HE	x200	Lymphoma(T-LBL)	BC3		82
22	MNU-3-1-6/Thy/Thy1	Thymus	Thy1	x200				
23	MNU-3-1-6/Thy/CD3	Thymus	CD3	x200				
24	MNU-3-2-6/Thy/HE	Thymus	HE	x200				
25	MNU-3-2-6/Thy/Thy1	Thymus	Thy1	x200				
26	MNU-3-2-6/Thy/CD3	Thymus	CD3	x200	Thymic Lymphoma(T-LBL)	BC3		104
27	MNU-3-2-9/Liv/HE	Liver	HE	x200				
28	MNU-3-2-9/Liv/CD3	Liver	CD3	x200				
29	MNU-3-2-9/Sp/HE	Spleen	HE	x200				
30	MNU-3-2-9/Sp/CD3	Spleen	CD3	x200				
31	MNU-3-3-10/Liv/HE	Liver	HE	x200	Thymic Lymphoma(T-LBL)	BC3		104
32	MNU-3-3-10/Liv/CD3	Liver	CD3	x200				
33	MNU-3-3-10/Sp/HE	Spleen	HE	x200				
34	MNU-3-3-10/Sp/CD3	Spleen	CD3	x200				
35	MNU-3-3-10/LN/HE	LN	HE	x200				
36	MNU-3-3-10/LN/CD3	LN	CD3	x200				

**Selected Digital Pictures from the Groups of MNU-Injected Mice**  
**MO: DATA3-3 (Cont'd)**

Folder: MNU/Lymphoma2								
No.	File Name	Object	Stain	P.Mag.	Diagnosis(REAL)	Strain	Dose	Day
1	MNU-3-2-8/LN/HE	LN	HE	x200	Lymphoma	BC3		102
2	MNU-3-2-8/LN/CD3	LN	CD3	x200				
3	MNU-4-1-2/Thy/HE	Thy	HE	x200	Thymic Lymphoma(T-LBL)	C3H		46
4	MNU-4-1-7/Liv/HE	Liver	HE	x200	Thymic Lymphoma(T-LBL)	C3H		67
5	MNU-4-1-7/Liv/CD3	Liver	CD3	x200				
6	MNU-4-1-7/Sp/HE	Spleen	HE	x200				
7	MNU-4-1-7/Sp/CD3	Spleen	CD3	x200				
8	MNU-4-2-5/Liv/HE	Liver	HE	x200	Thymic Lymphoma(T-LBL)	C3H		67
9	MNU-4-2-5/Liv/CD3	Liver	CD3	x200				
10	MNU-5-1-2/Liv/HE	Liver	HE	x200	Thymic Lymphoma(T-LBL)	C57		34
11	MNU-5-1-2/Liv/CD3	Liver	CD3	x200				
12	MNU-5-1-2/Sp/HE	Spleen	HE	X200				
13	MNU-5-1-2/Sp/CD3	Spleen	CD3	x200				
14	MNU-5-1-6/Liv/HE	Liver	HE	x200	Thymic Lymphoma(T-LBL)	C57		50
15	MNU-5-1-6/Liv/CD3	Liver	CD3	x200				
16	MNU-5-1-6/Sp/HE	Spleen	HE	x200				
17	MNU-5-1-6/Sp/CD3	Spleen	CD3	x200				
18	MNU-5-2-8/Liv/HE	Liver	HE	x200	Thymic Lymphoma(T-LBL)	C57		57
19	MNU-5-2-8/Liv/CD3	Liver	CD3	x200				
20	MNU-5-2-8/Sp/HE	Spleen	HE	x200				
21	MNU-5-2-8/Sp/CD3	Spleen	CD3	x200				
22	MNU-5-2-8/Thy/HE	Thymus	HE	x200				
23	MNU-5-2-8/Thy/CD3	Thymus	CD3	x200				
24	MNU-5-3-5/Liv/HE	Liver	HE	x200	Thymic Lymphoma(T-LBL)	C57		65
25	MNU-5-3-5/Liv/CD3	Liver	CD3	x200				
26	MNU-5-3-10/Liv/HE	Liver	HE	x200	Thymic Lymphoma(T-LBL)	C57		72
27	MNU-5-3-10/Liv/CD3	Liver	CD3	x200				
28	MNU-5-3-10/Thy/HE	Thymus	HE	x200				
29	MNU-5-3-10/Thy/CD3	Thymus	CD3	x200				
30	MNU-6-2-4/Liv/HE	Liver	HE	x200	Lymphoma(T-LBL)	BC3		71
31	MNU-6-2-4/Liv/CD3	Liver	CD3	x200				
32	MNU-6-2-4/Sp/HE	Spleen	HE	x200				
33	MNU-6-2-4/Sp/CD5	Spleen	CD5	x200				
34	MNU-6-2-4/Sp/CD3	Spleen	CD3	x200				
35	MNU-6-2-4/LN/HE	LN	HE	x200				
36	MNU-6-2-4/LN/CD3	LN	CD3	x200				
37	MNU-6-2-4/Thy/HE	Thymus	HE	x400				

**MO: DATA3-3 (Cont'd)**

Folder: MNU/Lymphoma3								
No.	File Name	Object	Stain	P.Mag.	Diagnosis(REAL)	Strain	Dose	Day
1	MNU-6-2-6/Liv/HE	Liver	HE	x200	Thymic Lymphoma(T-LBL)	BC3		74
2	MNU-6-2-6/Liv/CD3	Liver	CD3	x200				
3	MNU-6-2-6/Sp/HE	Spleen	HE	x200				
4	MNU-6-2-6/Sp/Thy1	Spleen	Thy1	x200				
5	MNU-6-2-6/Sp/CD5	Spleen	CD5	x200				
6	MNU-6-2-6/Sp/CD3	Spleen	CD3	x200				
7	MNU-6-2-6/Thy/HE	Thymus	HE	x400				
8	MNU-6-2-6/Thy2/HE	Thymus	HE	x400				

**Selected Digital Pictures from the Groups of  $\gamma$ -Irradiated Mice**  
**MO: DATA3-4**

Folder: gamma/Lymphoma1								
No.	File Name	Object	Stain	P.Mag.	Diagnosis(REAL)	Strain	Dose	Day
1	g-1-3-2-1/Sp1/HE	Spleen	HE	x100	Leukemic Lymphoma(B-Lym)	C3H	3	231
2	g-1-3-2-1/Sp2/HE	"	"	x200				
3	g-1-3-2-1/Sp3/HE	"	"	x400				
4	g-2-3-1-1/Sp1/HE	Spleen	HE	x100	Lymphoma(T-Lym)	C57	3	256
5	g-2-3-1-1/Sp2/HE	"	"	x200				
6	g-2-3-1-1/Sp3/HE	"	"	x400				
7	g-1-3-4-1/Liv/HE	Liver	HE	x400	Lymphoma(T-Lym)	C3H	3	258
8	g-1-3-4-1/Liv/CD3	"	CD3	x400				
9	g-1-3-4-1/Sp/HE	Spleen	HE	x200				
10	g-1-3-4-1/Sp/CD3	"	CD3	x200	Lymphatic Lymphoma(LBL)	C3H	3	405
11	g-4-3-3-1/Liv1/HE	Liver	HE	x200				
12	g-4-3-3-1/Liv2/HE	"	"	x200				
13	g-5-3-1-1/Liv1/CD5	Liver	CD5	x200	Myeloid Leukemia?	C57	3	384
14	g-5-3-1-1/Liv2/CD5	"	"	x200				
15	g-2-3-2-2/Liv1/CD3	Liver	CD3	x200				
16	g-2-3-2-2/Liv2/CD3	"	"	x200	Lymphoma(T-Lym)	C57	3	458
17	g-2-3-4-1/Liv/HE	Liver	HE	x200				
18	g-2-3-4-1/Sp/HE	Spleen	HE	x200				
19	g-2-3-4-1/Sp/CD3	"	CD3	x200	Lymphoma(T-LBL)	C57	3	475
20	g-2-3-4-1/LN/CD3	LN	CD3	x200				
21	g-3-3-2-1/Liv/HE	Liver	HE	x200				
22	g-3-3-2-1/Liv/HE2	"	"	x400	Leukemic Lymphoma	BC3	3	460
23	g-5-Ct-1-1/Liv1/HE	Liver	HE	x200				
24	g-5-Ct-1-1/Liv1/CD3	"	CD3	x200				
25	g-5-Ct-1-1/Liv2/HE	"	HE	x200	Thymic Lymphoma	C57	0	438
26	g-5-Ct-1-1/Liv2/CD3	"	CD3	x200				
27	g-5-Ct-1-1/LN/HE	LN	HE	x200				
28	g-5-Ct-1-1/LN/CD3	"	CD3	x200	Thymic Lymphoma(T-LBL)	BC3	2	425
29	g-6-2-4-1/Thy1/HE	Thymus	HE	x200				
30	g-6-2-4-1/Thy1/CD3	"	CD3	x200				
31	g-6-2-4-1/Thy2/HE	"	HE	x200				
32	g-6-2-4-1/Thy2/CD3	"	CD3	x200				
33	g-6-2-4-1/MesLN1/HE	MesLN	HE	x400				
34	g-6-2-4-1/MesLN2/HE	"	"	x400				
35	g-6-2-4-1/MesLN3/HE	"	"	x400				
36	g-6-2-4-1/MesLN4/HE	"	"	x400				

**Selected Digital Pictures from the Groups of  $\gamma$ -Irradiated Mice**  
**MO: DATA3-4 (Cont'd)**

Folder: gamma/Lymphoma2								
No.	File Name	Object	Stain	P.Mag.	Diagnosis(REAL)	Strain	Dose	Day
1	g-3-2-4-2/LN1/HE	LN	HE	x400	Lymphoma(Pre-B)	BC3	2	510
2	g-3-2-4-2/LN1/B220	"	B220	x400				
3	g-3-2-4-2/LN2/HE	"	HE	x200				
4	g-3-2-4-2/LN2/B220	"	B220	x200				
5	g-1-Ct-2-1/Sp1/HE	Spleen	HE	x200	Lymphoma(T-LBL)	C3H	0	551
6	g-1-Ct-2-1/Sp1/CD3	"	CD3	x200				
7	g-1-Ct-2-1/Sp2/HE	"	HE	x200				
8	g-1-Ct-2-1/Sp2/CD3	"	CD3	x200				
9	g-1-Ct-2-1/Sp3/HE	"	HE	x200				
10	g-1-Ct-2-1/Sp3/CD3	"	CD3	x200				
11	g-2-1-3-1/LN1/HE	LN	HE	x200	Histiocytic Sarcoma	C57	1	592
12	g-2-1-3-1/LN1/CD5	"	CD5	x200				
13	g-2-1-3-1/LN2/HE	"	HE	x200				
14	g-2-1-3-1/LN3/HE	"	HE	x200				
15	g-2-1-3-1/LN3/CD5	"	CD5	x200				
16	g-2-1-3-1/LN4/HE	"	HE	x200				

## 5. Related Papers, Publications & Reports

### Related Papers

- \* Ishigure, N., Nakano, T., Enomoto, H., Fukuda, S., Iida, H., Oghiso, Y., Yamada, Y., and Inaba, J. Assessment of initial alveolar deposition on rats exposed to plutonium aerosols using a whole body counter. *Hoken Butsuri* **27**: 135-142, 1992.
- \* Ishigure, N., Nakano, T., Enomoto, H., Iida, H., Oghiso, Y., Sato, H., Takahashi, S., Yamada, Y., Koizumi, A., Yamada, Y., Miyamoto, K. and Inaba, J. Lung retention of Pu following inhalation of PuO<sub>2</sub> in rats measured using a whole body counter. *J. Radiat. Res.* **35**: 16-25, 1994.
- \* Yamada, Y., Oghiso, Y., Enomoto, H., and Ishigure, N. Induction of micronuclei in a rat alveolar epithelial cell line by alpha particle irradiation. *Radiat. Protect. Dosimetry* **99**: 219-212, 2002.
- \* Fritsch, P., Dudoignon, N., Guillet, K., Oghiso, Y., Morlier, J.P., and Monchaux, G. Does mean lung dose calculated after inhalation of  $\alpha$  emitters actually reflect the risk of malignant lung tumor induction ? *Radiat. Protect. Dosimetry* **104**: 2003 (in press)

### Proceedings & Publications

- \* Inaba, J., Takahashi, S., Sato, H., Ishigure, N., Nakano, T., Enomoto, H., Oghiso, Y., Fukuda, S., Yamada, Y., Iida, H., Koizumi, A., Yamada, Y., and Miyamoto, K. Biokinetics and biological effects of inhaled plutonium in rat. *Proceedings of International Conference on Radiation Effects and Protection*, pp.247-249, 1992.
- \* Oghiso, Y., Ishigure, N., Yamada, Y., Sato, H., Fukuda, S., and Inaba, J. Differential induction of benign and malignant lung tumors in the rat after inhalation of plutonium dioxide. *Proceedings of 10th International Congress of Radiation Research*, pp.315, 1995.
- \* Oghiso, Y. and Yamada, Y. Pulmonary carcinogenesis in the rat after inhalation of plutonium dioxide aerosols: dose responses and pathogenesis. *Proceedings of 2nd Japn-France Workshop on Radiobiology and Isotopic Imaging*, pp.1-5, 1998.
- \* Oghiso, Y., Yamada, Y., Ishigure, N., Yamada, Y., and Inaba, J. Experimental pulmonary carcinogenesis in the rat after inhalation exposures to submicronmeter-size plutonium dioxide aerosols. *Proceedings of 11th International Congress of Radiation Research*, pp.811-818, 1999.
- \* Oghiso, Y. Differential dose responses of pulmonary tumors in rats after inhalation of insoluble plutonium dioxide aerosols. In: *Indoor Radon Exposures and Its Health Consequences*, Eds. J. inaba, H. Yonehara, and M. Doi, pp.155-161, Kodansha Scientific Ltd., Tokyo, 1999.
- \* Oghiso, Y., Yamada, Y., and Inaba, J. Lifespan animal studies on cacinogenesis following plutonium-exposures. *Proceedings of International Symposium on Biological Effects of Low Dose Radiation*, pp.80-86, 1999.
- \* Yamada, Y., Oghiso, Y., Nakamura, S., Morlier, J.P., Guillet, K., Fritsch, P., Dudoignon, N., and Monchaux, G. Comparison of p53 mutations in radiation-induced rat lung tumors. *Proceedings of International Symposium on Biological Effects of Low Dose Radiation*, pp.131-135, 2002.

## Annual Reports

- \* Ishigure, N., Nakano, T., Enomoto, H., Fukuda, S., Iida, H., Oghiso, Y., Yamada, Y., and Inaba, J. Assessment of initial alveolar deposition on rats exposed to plutonium aerosols using a whole body counter. NIRS Annual Report 1992-1993, NIRS-32, pp.63-64, 1993.
- \* Oghiso, Y., Fukuda, S., Yamada, Y., Iida, H., Yamada, Y., Sato, H., Ishigure, N., Koizumi, A., and Inaba, J. Carcinogenic effects of plutonium-239 - current summary on life-span studies in experimental rats and mice. NIRS Annual Report 1993-1994, NIRS-33, pp.59-60, 1994.
- \* Oghiso, Y., Fukuda, S., Yamada, Y., Iida, H., Yamada, Y., Ishigure, N., Sato, H., Koizumi, A., and Inaba, J. Life-span studies on carcinogenic effects of inhaled or injected plutonium in experimental rats and mice. NIRS Annual Report 1994-1995, NIRS-34, pp.57, 1995.
- \* Oghiso, Y. and Yamada, Y. Frequency of p53 mutations in the rat lung carcinomas after inhalation of  $^{239}\text{PuO}_2$  aerosols. NIRS Annual Report 1997-1998, NIRS-37, pp.59, 1998.
- \* Oghiso, Y., Yamada, Y., and Fukutsu, K. Sequential study on pathogenesis of lung tumors in rats following inhalation exposures to plutonium dioxide aerosols. NIRS Annual Report 1998-1999, NIRS-38, pp.65, 1999.
- \* Oghiso, Y. and Yamada, Y. Strain differences in carcinogenic and hemopoietic responses of mice following injection of plutonium citrate. NIRS Annual Report 1999-2000, NIRS-39, pp.53, 2000.
- \* Oghiso, Y. and Yamada, Y. Immunohistochemical study on cellular origins of rat lung tumors induced by inhalation exposure to plutonium dioxide and by X-ray irradiation. NIRS Annual Report 2001-2002, NIRS-41, pp.56-57, 2002.
- \* Yamada, Y., Oghiso, Y., Enomoto, H., and Ishigure, N. Induction of micronuclei in rat alveolar epithelial cell line by alpha particle irradiation. NIRS Annual Report 2001-2002, NIRS-41, pp.57, 2002.
- \* Oghiso, Y. and Yamada, Y. Murine pre-B-cell lymphomas following injection of plutonium citrate in comparison to MNU-induced T-lymphoblastic lymphomas. NIRS Annual Report 2002-2003, NIRS-42, pp.58, 2003.
- \* Yamada, Y., Oghiso, Y., Nakamura, S., Morlier, J-P., Guillet, K., Fritsch, P., Dudoignon, N., and Monchaux, G. Comparative study on *Tp53* mutations in rat lung tumors induced by inhalation exposure to alpha emitters and X-ray irradiation. NIRS Annual Report 2002-2003, NIRS-42, pp.64-65, 2003.
- \* Oghiso, Y. and Yamada, Y. Pulmonary carcinogenesis in the rat following inhalation exposure to plutonium dioxide in comparison to X-ray irradiation. NIRS Annual Report 2002-2003, NIRS-42, pp.65, 2003.
- \* Oghiso, Y. and Yamada, Y. Specific induction of osteosarcomas in different mouse strains following injection of plutonium citrate. NIRS Annual Report 2002-2003, NIRS-42, pp.66, 2003.

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