TABLE 1:
Estimated Amounts of Materials arising from the Dismantling of Nuclear Reactors (Unit: thousand metric tons)

Reactor Type	Waste Category / Materials	LLW (I)	LLW (II)	VLLW	Below clearance level	Non-radioactive materials	Total
BWR (110 MWe)	Metal	0.1	2	<10	21	8	40
	Concrete	0	<1	<10	8	487	500
	Total	***0.1***	***2***	***10***	***30***	***500***	***540***
PWR (110 MWe)	Metal	0.1	2	2	3	34	40
	Concrete	0.1	<1	1	9	443	450
	Total	***0.2***	***3***	***3***	***10***	***480***	***500***
GCR (160 MWe)	Metal	0.2	2	3	1	6	10
	Concrete	3	10	5	10	115	140
	Total	***3***	***12***	***8***	***10***	***120***	***160***
HWR (FUGEN)	Metal	<0.2	1	2	4	10	20
	Concrete	0	0	1	30	320	350
	Total	***<0.2***	***1***	***3***	***34***	***330***	***370***
FBR (JOYO)	Metal	<1		<1	1	2	<10
	Concrete	0		1	1	280	280
	Total	***<1***		***<2***	***3***	***282***	***290***

Note 1: *LLW (I) means the radioactive wastes whose radioactivity levels are greater than the upper bound concentrations for near surface disposal in Japan. On the other hand, LLW (II) means radioactive waste whose radioactivity levels are less than the upper bound concentrations for near surface disposal.*
Note 2: *FUGEN is the heavy water moderated and boiling light water cooled reactor and JOYO is the experimental FBR operated in JNC.*
Note 3: *The quantities of the materials below the clearance levels are estimated by using the representative values that are shown in IAEA -TECDOC-855 [1].*
Note 4: *These numerous values are shown in this table are rounded. So, the total is not equal to the sum of each numerous value.*

Exposure pathways

For this analysis, two scenarios were considered:

- Landfill disposal in both terrestrial and marine environments, and
- Recycling of steel and concrete, and reuse of equipment (with surface contamination).

The reason why the landfills in both terrestrial and marine environments were considered was that both are common methods for disposal of municipal and industrial wastes in Japan. These two scenarios were subdivided into various sub-scenarios and exposure pathways describing the activities of specific individuals. First, all possible exposure pathways, 202 total pathways, were considered. Then, the exposure pathways, which might result in small doses, were omitted from the consideration. Finally, 41 exposure pathways for disposal and 32 exposure pathways for recycle/reuse were chosen, which are shown in TABLE 2 and TABLE 3 respectively. Humans who are involved in these exposure pathways may be exposed to radiation in three main ways:

- Exposure to external radiation.
- Inhalation of radioactive gases or small particles.
- Ingestion of foodstuffs containing radionuclides or radioactive material.

The exposure ways were considered about each exposure pathways.

Calculation model and parameters

In this analysis, deterministic calculation models were established to assess individual dose from selected 73 exposure pathways. Numerical formulas to express calculation model are described in the NSC's report [2], and reference [7].

The realistic parameter values, namely mean or most probable values were selected, considering natural and social conditions in Japan. It, however, was very difficult to select an appropriate value for each parameter, especially for ones depending on natural conditions such as groundwater velocity and length of saturated zone. Therefore, the JAERI also performed a stochastic approach to validate the calculation results obtained with the deterministic one [8]. On the basis of the results, the values of some parameters were modified to more appropriate ones.

The dose conversion factors for inhalation and ingestion were taken from the JAERI's reports [9] [10] based on International Commission on Radiation Protection Publication No. 30 and No.48 [11] [12]. All parameter values and calculation models used in this analysis are described in the NSC's report [1].

TABLE 2:
DESCRIPTIONS OF EXPOSURE PATHWAYS FOR THE DISPOSAL SCENARIO

SUB-SCENARIO	EXPOSURE PATHWAY	INDIVIDUAL CONSIDERED	CATEGORY OF EXPOSURE
OPERATIONS OF THE WASTES DISPOSAL	Loading wastes to truck	Equipment operator	External Inhalation
	Transportation	Truck driver	External Inhalation
	Landfill	Equipment operator	External Inhalation
	Inhalation of tritium gas	Equipment operator Off-site resident	Inhalation
DISTURBANCE OF THE LANDFILL SITE AFTER THE CLOSURE	Construction of a house	Construction worker	External Inhalation
	Residence	Resident	External Inhalation
	Agriculture	Farmer	External Inhalation
	Livestock farming	Farmer	External Inhalation
	Ingestion of crops cultivated in the landfill site	Consumer	Ingestion
	Ingestion of livestock grown with the feeds cultivated in the site	Consumer	Ingestion
GROUNDWATER MIGRATION	Ingestion of well water	Consumer	Ingestion
	Irrigation cultivation for food crops with well water	Farmer	External Inhalation
	Irrigation cultivation for feed with well water	Farmer	External Inhalation
	Ingestion of crops cultivated with well water	Consumer	Ingestion
	Ingestion of livestock grown with the feeds cultivated with well water	Consumer	Ingestion
	Ingestion of livestock grown with well water	Consumer	Ingestion
	Ingestion of freshwater products cultivated with well water	Consumer	Ingestion
	Fishery on the river	Fisherman	External
	Swimming in the river	Swimmer	External
	Ingestion of freshwater products caught in the river	Consumer	Ingestion
	Activities on the river shore	Worker	External Inhalation
	Handling of the fishery nets	Fisherman	External
SEA RECLAMATION	Ingestion of salt	Consumer	Ingestion
	Fishery on the marine	Fisherman	External
	Swimming in the marine	Swimmer	External
	Ingestion of products caught in the marine	Consumer	Ingestion
	Activities on the sea shore	Worker	External Inhalation
	Inhalation of the sprayed sea water	Resident	Inhalation
	Handling of the fishery nets	Fisherman	External

TABLE 3:
Descriptions of Exposure Pathways for Recycle/reuse Scenario

Sub-scenario	Exposure pathway	Individual considered	Category of exposure
Scrap metals processing	Unloading scrap metals	Worker	External Inhalation
	Transportation	Driver	External
	Pretreatment	Worker	External Inhalation
	Smelting and casting	Worker	External
	Treatment of slag	Worker	Inhalation
	Fabrication	Worker	External Inhalation
	Inhalation of dust and ingestion of vegetables contaminated with downwind plume from the smelting factory	Downwind resident	Inhalation Ingestion
Consumer use of items made from recycled metal	Use of the refrigerator	Consumer	External
	Use of the bed	Consumer	External
	Ingestion of food cooked with the frying pan	Consumer	Ingestion
	Ingestion of the caned beverage	Consumer	Ingestion
	Residence in the room built with the reinforcement bars	Resident	External
	Ingestion of tap water through the water pipes	Resident	Ingestion
	Automobile	Driver	External
	Truck	Driver	External
	Ship	Sailor	External
	Desk	Office worker	External
	Numerical controlled lathe	Lathe operator	External
	Slag use in asphalt parking lot	Manager of the parking lot	External
Concrete processing	Crushing concrete	Worker	External Inhalation
	Inhalation of dust and ingestion of vegetables contaminated with downwind plume from the concrete crushing factory	Downwind resident	Inhalation Ingestion
Consumer use of items made from recycled concrete	Residence in the room built with the aggregates	Resident	External
	Concrete use in asphalt parking lot	Manager of the parking lot	External
Reuse	Reuse of equipment	Worker	External Inhalation Ingestion

Derivation results

Using the refined parameter values, the clearance levels for major 21 radionuclides were derived. The Clearance levels are expressed in units of Bq/g or Bq/cm2 equivalent to individual dose of 10μSv/yr. The minimum value of all exposure pathways was defined as unconditional clearance level for each radionuclide. Table 4 shows the unconditional clearance levels and the limited scenario and exposure pathway caused the value.

Table 4:
Derived Unconditional Clearance Levels for Solid Materials arising from Nuclear Reactors and Limiting Exposure Pathways

Radionuclide	Clearance levels (Bq/g)	Limiting scenario and exposure pathway		TECDOC-855 (Bq/g)	
		Scenario	Exposure pathway	Ranges	Single
H-3	200	Disposal	Ingestion of crops cultivated in the landfill site	1000 – 10000	3000
C-14	5		Ingestion of freshwater products cultivated with well water	100 – 1000	300
Cl-36	2		Ingestion of crops cultivated with well water	100 – 1000	300
Ca-41	80			N.A.*2	
Mn-54	1		External exposure on waste disposal	0.1 – 1	0.3
Fe-55*1	3000*1	Recycle/ reuse	External exposure from reused equipment	100 – 1000	300
Co-60	0.4	Disposal	External exposure on waste disposal	0.1 – 1	0.3
Ni-59	600		Ingestion of crops cultivated with well water	N.A.*2	
Ni-63	2000		Ingestion of livestock grown with the feeds cultivated in the site	1000 – 10000	3000
Zn-65	1		External exposure on waste disposal	0.1 – 1	0.3
Sr-90	1		Ingestion of crops cultivated in the landfill site	1 – 10	3
Nb-94	0.2		External exposure of the resident in the landfill site	0.1 – 1	0.3
Tc-99	0.3		Ingestion of crops cultivated in the landfill site	100 – 1000	300
I-129	0.7		Ingestion of well water	10 – 100	30
Cs-134	0.5	Recycle/ reuse	External exposure on the asphalt parking lot built with slag	0.1 – 1	0.3
Cs-137	1			0.1 – 1	0.3
Eu-152	0.4			0.1 – 1	0.3
Eu-154	0.4			N.A.*2	
Pu-239	0.2		Inhalation of dust on unloading scrap metals	0.1 – 1	0.3
Am-241	0.2			0.1 – 1	0.3

**1: The unit of the clearance level for Fe-55 is Bq/cm² because the limiting pathway is reuse of the surface contaminated equipment.*
**2: Clearance levels for these radionuclides are not available in IAEA-TECDOC-855.*

METHODOLOGY

In the derivation of the clearance levels for solid materials arising from PIE facilities, the applied methodology was the same as one for nuclear reactors. Additionally the same source term, the same exposure pathways and the same deterministic calculation models were used, considering that the dismantling of PIE facilities generate mostly concrete and metal and that the amounts of them and the ratios of the cleared materials to the amounts were smaller than those of nuclear reactors. The same source term leads conservative values in the derivation of clearance levels for PIE facilities. Table 5 shows the amounts of materials arising from the dismantling of major PIE facilities.

To calculate the clearance levels, major 49 were selected among radionuclides contained in irradiated nuclear fuels and materials examined in PIE facilities. These include 13, which had already been discussed on the derivation for nuclear reactors.

The same parameter values used in the discussion on nuclear reactors were adopted, and for new parameters peculiar to new 36 radionuclides, the realistic values were selected with the same way in the discussion on nuclear reactors

TABLE 5:
THE ESTIMATED AMOUNTS OF MATERIALS ARISING FROM THE DISMANTLING OF PIE FACILITIES (UNIT: THOUSAND METRIC TON)

PIE FACLITIES	WASTE CATEGORY / MATERIALS	LLW (I)	LLW (II)	VLLW	BELOW CLEARANCE LEVEL	NON-RADIOACTIVE MATERIALS	TOTAL
HOT LABORATORY	Metal	0	0.1	0.05	0.7	0.3	1
	Concrete	0	0	0	0.2	21	21
	Lead	0	0	0	0.15	0.05	0.2
	Total	0	0.1	0.05	1	21	22
FMF	Metal	0	0.8	0.2	1	2	4
	Concrete	0	0	0	0.4	68	68
	Lead	0	0	0	0.003	0.3	0.3
	Total	0	0.8	0.2	1	70	72

Note 1: *LLW (I) means the radioactive wastes whose radioactivity levels are greater than the upper bound concentrations for near surface disposal in Japan. On the other hand, LLW (II) means radioactive waste whose radioactivity levels are less than the upper bound concentrations for near surface disposal.*
Note 2: *Hot Laboratory and FMF are representative PIE facilities operated in JAERI and JNC, respectively.*
Note 3: *The quantities of the materials below the clearance levels are estimated by using the representative values that are shown in IAEA -TECDOC-855 [1].*
Note 4: *These numerous values are shown in this table are rounded. So, the total is not equal to the sum of each numerous value.*

TABLE 6:
Derived Unconditional Clearance Levels for solid materials arising from PIE facilities and Limiting Exposure Pathways

Radionuclide	Clearance levels (Bq/g)	Limiting scenario and exposure pathway: Scenario	Exposure pathway	TECDOC-855 (Bq/g): Ranges	Single
H-3[*3]	200	Disposal	Ingestion of crops cultivated in the landfill site	1000 – 10000	3000
C-14[*3]	5		Ingestion of freshwater products cultivated with well water	100 – 1000	300
Sc-46	2		External exposure on waste disposal	N.A.[*2]	
Mn-54[*3]	1			0.1 – 1	0.3
Fe-55[*1*3]	3000*1	Recycle/ reuse	External exposure from reused equipment	100 – 1000	300
Co-58	0.9			1-10	3
Co-60[*3]	0.4			0.1 – 1	0.3
Zn-65[*3]	1			0.1 – 1	0.3
Sr-89	600		Ingestion of crops contaminated with plume	100 - 1000	300
Sr-90[*3]	1	Disposal	Ingestion of crops cultivated in the landfill site	1-10	3
Y-91	200		External exposure on waste disposal	N.A.[*2]	
Zr-95	1.1			N.A.[*2]	
Nb-94[*3]	0.2		External exposure of the resident in the landfill site	0.1 – 1	0.3
Nb-95	1		External exposure on waste disposal	N.A.[*2]	
Ru-103	2		External exposure of transportation of waste	N.A.[*2]	
Ru-106	5			1 - 10	3
Ag-108m	0.3		External exposure of the resident in the landfill site	N.A.[*2]	
Ag-110m	0.4		External exposure on waste disposal	0.1 - 10	0.3
In-114m	9		External exposure of transportation of waste	N.A.[*2]	
Sn-113	3			N.A.[*2]	
Sn-119m[*1]	800	Recycle/ reuse	External exposure from reused equipment	N.A.[*2]	
Sn-123	100	Disposal	External exposure on waste disposal	N.A.[*2]	
Sb-124	0.5			0.1 - 10	0.3
Sb-125	2			N.A.[*2]	
Te-125m	200	Recycle/ reuse	Ingestion of crops contaminated with plume	N.A.[*2]	
Te-127m	60			N.A.[*2]	
Te-129m	10	Disposal	External exposure of transportation of waste	N.A.[*2]	
Cs-134[*3]	0.5	Recycle/ reuse	External exposure on the asphalt parking lot built with slag	0.1 – 1	0.3
Cs-137[*3]	1			0.1 – 1	0.3
Ce-141	10	Disposal	External exposure of transportation of waste	N.A.[*2]	

RADIONUCLIDE	CLEARANCE LEVELS	LIMITING SCENARIO AND EXPOSURE PATHWAY		TECDOC-855 (BQ/G)	
	(BQ/G)	SCENARIO	EXPOSURE PATHWAY	RANGES	SINGLE
Ce-144	20			10 - 100	30
Pm-148m	0.5		External exposure on waste disposal	N.A.*2	
Eu-154*3	0.4	Recycle/ reuse	External exposure on the asphalt parking lot built with slag	N.A.*2	
Eu-155	10	Disposal	External exposure of transportation of waste	N.A.*2	
Gd-153	10			N.A.*2	
Tb-160	0.9		External exposure on waste disposal	N.A.*2	
Hf-181	1		External exposure of transportation of waste	N.A.*2	
Ta-182	0.7		External exposure on waste disposal	N.A.*2	
Pu-238	0.2	Recycle/ reuse	Inhalation of dust on unloading scrap metals	N.A.*2	
Pu-239*3	0.2			0.1 - 1	0.3
Pu-240	0.2			0.1 – 1	0.3
Pu-241	10			10 - 100	30
Am-241*3	0.2			0.1 – 1	0.3
Am-242m	0.2			N.A.*2	
Am-243	0.2			N.A.*2	
Cm-242	5			N.A.*2	
Cm-243	0.3			N.A.*2	
Cm-244	0.4			0.1 - 1	0.3

**1: The unit of the clearance level for Fe-55 and Sn-119m is Bq/cm2 because the limiting pathway is reuse of the surface contaminated equipment.*
**2: Clearance levels for these radionuclides are not available in IAEA-TECDOC-855.*
**3: Radionuclides drawn to the underline are also derived at the nuclear reactors' derivation.*

DISCUSSION

In Table 4 and 6, the results of the clearance levels for both nuclear reactors and PIE facilities are compared with those described in IAEA- TECDOC-855. Most of derived clearance levels (e.g., γ-ray emitters such as Co-60 and α-ray emitters such as Pu-239) were nearly the same as those in the IAEA - TECDOC-855. Some (e.g., β-ray emitters such as Tc-99 and I-129), however, were different. The major differences between this analysis and IAEA-TECDOC-855 are as follows:

- Derived value of Fe-55 was higher than that of IAEA by one order of magnitude.
- Derived value of H-3, C-14, Co-58, Fe-59 and I-129 were lower than that of IAEA by one order of magnitude.
- Derived value of Cl-36 and Tc-99 were lower than that of IAEA by two orders of magnitude.

It is difficult to make these differences clear because IAEA's levels were derived based on review of some literatures. Major reasons for these differences might be as follows:

- The mixture with cleared scrap metals and non-radioactive metals was not considered in the literature refereed for Fe-55 in IAEA.
- The common limiting pathway for H-3 and Tc-99, which is the ingestion of crops cultivated in the landfill site, is finally omitted from the consideration in IAEA.
- In this analysis the limiting exposure pathways for C-14, Cl-36 and I-129 are the related ones to the radionuclides migration via groundwater, but these pathways are not considered or finally omitted in the consideration in IAEA.
- For Fe-59 and Co-58, parameter values such as the mixture ratio of cleared waste to non-radioactive one and working hours of operator were different between in this analysis and IAEA.
- Calculation model and parameter values were different between these derivations.

The clearance levels of PIE facilities will be authorized after calculation results are validated with the stochastic approach. The clearance levels for the solid materials arising from other facilities such as radioisotope utilization facilities and accelerators will be derived after establishment of a source term, exposure pathways, value of parameters and so on.

REFERENCES

[1] International Atomic Energy Agency, "Clearance Levels for Radionuclides in Solid Materials; Application of Exemption Principles", Interim Report for Comment-, IAEA-TECDOC-855, IAEA, Vienna (1996)

[2] Nuclear Safety Commission, "Clearance Levels for Solid Materials Arising from Main Reactors", NSC, Tokyo (1999) (in Japanese)

[3] Nuclear Safety Commission, "Clearance Levels for Solid Materials Arising from Heavy Water Reactors and Fast Breeder Reactors", NSC, Tokyo (1999) (in Japanese)

[4] Radiation Council, Exemption Dose Criteria for the Near Surface Disposal of Solid Radioactive Wastes, Tokyo (1987) (in Japanese)

[5] International Commission On Radiological Protection, Radiation Protection Principles for the Disposal of Solid Radioactive Waste, Publication 46, Pergamon Press, Oxford (1985)

[6] International Atomic Energy Agency, Principles for the Exemption of Radiation Sources and Practices from Regulatory Control, Safety Series No.89, IAEA, Vienna (1988)

[7] M. Okoshi, et al., "Deterministic Approach towards Establishing of Clearance Levels in Japan", Proc. Int. Conference on Radioactive Waste Management and Environmental Remediation, Nagoya, Japan (1999)

[8] T. Takahashi, et al., "Stochastic Approach to Confirm the Derivation of Clearance Levels", Proc. Int. Conference on Radioactive Waste Management and Environmental Remediation, Nagoya, Japan (1999)

[9] K. Kawai, H. Tachibana, T. Hattori and S. Suga, Table of Committed Effective Dose Equivalent etc. per Unit Intake based on ICRP Publication 30, JAERI-M 87-172, JAERI, Tokyo (1987) (in Japanese)

[10] K. Kawai, O. Togawa, Y. Yamaguchi, S. Suga and T. Numakunai, Table of Committed Effective Dose Equivalent etc. per Unit Intake of Actinide Elements Conformable to Radiation Protection Regulations (Supplement to JAERI-M 87-172), JAERI-M 90-022, JAERI, Tokyo (1990) (in Japanese)

[11] International Commission On Radiological Protection, Limits for Intakes of Radionuclides by Workers, ICRP Publication 30 Part 1 (and subsequent parts and supplements), Vol. 2 No. 3-4 through Vol. 8 No. 4, Pergamon Press, Oxford (1977-1982)

[12] International Commission On Radiological Protection, The Metabolism of Plutonium and Related Elements, ICRP Publication 48, Pergamon Press, Oxford (1986)

Developing a Technical Basis for Release of Solid Materials

Robert Meck
U.S. Nuclear Regulatory Commission

Seven years ago, I met with this group in Tokai-mura, Japan, to compare the U.S. and Japanese plans for clearance of materials and equipment. This was my first trip to Japan. The experience was very enjoyable and gave many happy memories.

After seven years, let's look at the current status of NRC activity on the control of solid materials. For this presentation, first I'll set the stage from the overall regulatory viewpoint. Then, I'll show activities at the NRC. We will briefly talk about how licensees can handle materials and equipment and how these processes could be updated.

The main part of this presentation will be on the activities that could support a change and the next steps. Finally, you will see a schedule and conclusions.

First, there are some terms that we need to understand in the same way. "Clearance" is a process removing radiological controls that implies that controls are already in place. If one is removing the radiological controls from, say, metal or trash, then that person is said to clear the materials.

To clear materials or equipment, measurements of the concentrations of radioactivity are often required. Most of these concentrations have been determined to correspond to the highest reasonable dose of radiation to an individual or a group. These concentrations are called "clearance levels." This is a generalized representation of the regulatory control system.

The box on the left represents all radiation sources. Some radiation sources such as potassium-40 in the body are unamenable to control. For that reason, they never enter into regulatory control. That's exclusion.

Other sources have very small quantities and small concentrations of radioactivity and are intrinsically safe. An example would be smoke detectors used in the home. These are exempted from regulatory control by the regulatory authorities. This is exemption.

Some practices that are under regulatory control release small amounts of radioactivity into the environment as a gas or a liquid under normal operations. The benefits of the normal operations outweigh the detriment of the environmental releases. This is referred to as "authorized discharge."

Higher quantities and concentrations may require disposal in a licensed repository. Internationally, this is called "authorized disposal." Materials and equipment may leave regulatory control directly through clearance. Authorized release is a middle step between regulatory control and clearance. Conceptually, there can be a lessening of regulatory control in a transition. This would involve materials and equipment that are controlled so that they enter an intermediate step or process before they are cleared.

Usually, it is a process that removes or decays radioactivity or limits exposure of people by its use. For example, using metal as bridge girders.

So today, how do NRC licensees release materials and equipment? It depends. If the licensed radioactivity is part of the material itself, such as in neutron-activated metal, then the metal must go to an authorized disposal. That disposal could be in a low-level waste repository or on a case-by-case basis into another disposal, on site, a municipal landfill, or an industrial landfill.

If the radioactivity is on the surface, then the materials licensee can release material or equipment at "Fuel Cycle 83-23," levels, which are equivalent to the more familiar "Regulatory Guide 1.86," levels. Generally, these levels for beta gamma emitters is 5,000 dpm per 100 centimeters squared and for alpha emitters and certain other nuclides, 100, 1,000 or 5,000 dpm per 100 square centimeters depending on the list in a group. These averages are taken over a one-square meter area or less.

There are also criteria for the maximum concentration and the removable concentration, which are three times and one-fifth of the average respectively. Reactor licensees may not release any detectable radioactivity associated with materials or equipment. In general, they must be able to detect radioactivity at the environmental levels.

Where such measurements are impractical because of the size, shape or characteristic of the material or equipment and if the radioactivity is on the surface, then they may use deduction methods capable of detecting Regulatory Guide 1.86 levels. While materials and equipment are being released daily from licensees, improvements could be made. Improvements that have been presented as possibilities are consistency, for example, there are no regulations in place that apply to clearance.

You just heard the various different kinds of way that materials can be released from NRC licensees today. We need consistency. Current policies and practices treat reactor and material's licensees differently.

They could be treated consistently under a regulation. The levels used now are not dose or risk based. While there is adequate safety provided by the levels, it is uneven among different radionuclides. Generic clearance levels would provide relief for both regulators and licensees for making case-by-case determinations. Specification of both land and surface clearance levels would fill a regulatory vacuum. Given this situation, what is the NRC doing? The next slide lists these actions.

Basically, the Commission needs more information and they're going to get it in several ways. The National Academies' study is to investigate alternatives for the release of contaminated materials. They are to consider the issue of recycling as a separate issue from the release of slightly contaminated solid materials.

This direction may be interpreted as relating to the general concepts of clearance, authorized release, and authorized disposal that we saw in an earlier slide. We understand that the National Academies' committee has prepared a draft of their report but we are not allowed to know its contents until immediately before the release to the public.

Next, we're developing a technical basis. And this is what the program said that I would be talking about and I'm certainly willing to answer questions, either in the format that would keep us on schedule or at lunchtime.

The dose assessments for individuals will be finalized in NUREG-1640. A supplement will cover materials other than ferrous metals, aluminum, copper and concrete. The final version will respond to technical comments.

In addition, analysis of the inventory of materials and equipment that are likely to be cleared, collected doses and some costs are ongoing. NRC is also developing methods to measure low levels of radioactivity on and in materials and equipment.

On the next point, international initiatives, NRC continues to support the IAEA efforts to establish clearance levels. In addition, we are keeping informed on the implementation of clearance levels in the EU and other countries. Staff recommendations on how best to proceed will be an analysis of the options from the National Academies' report as well as staff input as appropriate.

Finally, there is work with EPA and DOE. EPA is in the process of posting an updating dose assessments for individuals on their clean metals website. EPA is not actively making a regulation on clearance. DOE is in the process of developing an Environmental Impact Statement for the release of metals with associated radioactivity on surfaces. NRC is actively coordinating assessments of DOE processes and inventory with DOE

So what is the schedule? The National Academies' report is due in February 2002. As for the technical bases, individual dose assessments and the finalization of NUREG-1640, they are expected in the summer of 2002. The supplement, which will address individual doses from other materials, will be published later. Inventory, collective dose and some costs are expected in the fall of 2002. Coordination with IAEA, EPA, and the DOE are ongoing. We will provide input as appropriate. Three months after the National Academies' report is published, the staff recommendations are due. That makes it the summer of 2002. It is difficult to predict when the Commission will respond to those recommendations.

The conclusions that one might draw from the current status are -- the Commission is actively supporting the development of information to help them decide if rulemaking on clearance and the control of solid material is to proceed. In view of the establishment of clearance criteria in other countries, it seems likely that the U.S. will need to at least address imports of cleared goods so some regulatory actions may be expected.

A Status Report on Recent Activities Related to the WIPP and Yucca Mountain Projects

Scott Monroe
U.S. Environmental Protection Agency, Radiation Protection Division

This paper is about Waste Isolation Pilot Plant (WIPP) and Yucca Mountain. First, a quick overview of the current activities on the work we've done to date on WIPP. I'll review the key elements of our radioactive waste disposal standards for the Yucca Mountain facility, issued in June of this year.

We'll begin with WIPP. Just to review quickly the roles and responsibilities of two of the major Federal agencies involved in this project, the Department of Energy (DOE) is the owner and operator of the WIPP site. They are responsible for the disposal operations and for complying with applicable Federal and State regulations.

The Environmental Protection Agency (EPA), by Congressional decree, was tasked with developing radioactive waste disposal regulations for the WIPP site for certifying whether or not the site could meet those regulations. If the answer was yes, then to recertify every five years that the site continues to be in compliance. And through each five-year period, during the operational phase, we would maintain an ongoing regulatory oversight role. Operations at the WIPP are expected to last about 35 years.

Some key dates. . . In 1985, EPA issued general radioactive waste disposal standards for transuranic waste. That's plutonium-contaminated trash, really, from the defense program in the United States, and also spent nuclear fuel and high-level waste. Those standards were revised in 1993.

In 1996, we issued disposal regulations that took the general standards and applied them specifically to WIPP. We received an application from the DOE. We reviewed that application and decided in 1998 that the site would comply with our disposal regulations. That decision allowed the WIPP to receive waste. The first shipment was received at the WIPP in March 1999. That shipment came from Los Alamos National Laboratories in New Mexico. This has to do with the need for the Department to demonstrate to the State of New Mexico that the first shipment did not contain mixed waste.

In October 1999, the State of New Mexico issued a hazardous waste disposal permit for WIPP and that allowed DOE to dispose of mixed radioactive and hazardous waste in this disposal facility. So the period we're in right now is preparing for the first WIPP recertification, which should occur in 2004, five years after waste was first sent to WIPP.

So to move into our current activity, we are preparing for recertification. I'm speaking as a regulator here. These are regulatory functions that we're engaged in, so we issue guidance to the department about what they need to do with their recertification application.

We issued guidance in December of last year. We may have to issue additional guidance. Mainly what we're doing is engaging in very frequent communication with the Department staff about what needs to be done in order for recertification to be successful. And we have to communicate with the concerned public, with the State of New Mexico and elsewhere.

As I mentioned, we also have an ongoing regulatory oversight role in addition to the recertification decision every five years. That takes the form of two main areas of activity. First, we complete inspections at WIPP sites and at sites operated by DOE around the country where transuranic waste is stored and characterized prior to disposal.

Also, we track changes that are initiated by the Department of Energy that could affect our certification. Their application contains an enormous number of commitments by the Department. We make sure that they hold true to those commitments. And if we determine that a change proposed by DOE is a significant enough departure from the application, we will modify our certification. That involves proposing to modify and then accepting public comment on that proposal and then making a final decision. And, of course, with these activities, we also have to communicate with the public.

WIPP has now been operating for a little over two years. They've disposed of roughly 11,000 55-gallon drums, with about 4000 shipments to date from these sites. These are all considered major sites with a larger amount of transuranic waste. The total volume is roughly 2,600 cubic meters. They're just getting started. And EPA has completed over 40 inspections to date. That's in about a three-year period at both the WIPP site and transuranic waste sites.

I'd like to say a little about why and where we do inspections. Inspections are a powerful tool for the regulator to verify compliance. When we go to the WIPP site to do an inspection, we look at several things. We look at their quality assurance program. There is a stringent standard for quality assurance that we apply to the WIPP program. We look at their environmental and disposal system monitoring. This would be monitoring for releases on the surface and also geological processes in the mine that could be related to performance. Also, we look at waste emplacement.

With regard to transuranic waste sites, depending how you define them, there are eight to ten major sites around the country and 13 to 18 smaller-quantity sites. These sites presently characterize waste prior to disposal, specifically to identify limited waste components. There are components such as metals, organic materials and radionuclides that were determined by DOE to be important to the WIPP's ability to contain radionuclides effectively. We also look at the quality assurance programs for those processes. So there is a quality aspect and also the technical evaluation that we do.

Lastly on WIPP, one point I'd like to make is that we have very broad regulatory authority over this program. We are authorized to suspend the certification temporarily. We're authorized to modify the certification to accommodate changes in activities or conditions. As I said, that would involve public comment. And we can also revoke the certification in the event of a failure to comply with our regulations. That would be basically a release into the accessible environment that exceeded our standards.

We have not modified our certification to date. We expect to have to. That could happen within the next year or so. And there was an event this summer where we suspended all shipments to the site until we could complete an investigation of a noncompliance at the site in Idaho. But that's the closest we've come to a suspension.

I'm going to move now to Yucca Mountain and explain the basic elements of the disposal standards that we issued this summer. You may already know this, but I'll run through it quickly.

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