## Case study in a hypothetical country A on POP-PBDEs in the Transport Sector

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**Scenario for this case study:** Country A has begun the process for updating its National Implementation Plan (NIP). The National Coordination Committee (NCC) was re-established with the inclusion of additional members capable of addressing the environmentally sound management (ESM) of new POPs.

**Step 1: Planning of the inventory**

Step 1-1 (Establish a National Inventory Team): A project office lead by a National Project Coordinator (NPC) and three inventory teams (POP-PBDEs and PFOS, new POPs pesticide, and unintentional POPs) were formed in the Ministry of Environment in charge to develop their respective national inventories for new POPs while updating existing inventories for the 12 original POPs. (see the POP-PBDEs Inventory Guidance, 2.1.1 in general and 5.3)

Step 1-2 (Define inventory objectives and scope): The project office lead the governmental effort to conduct an initial assessment by referring to the Stockholm Convention companion guide for reviewing and updating of the National Implementation Plan 2011. NPC and his team decided to conduct the POP-PBDEs inventory for the electric appliances / wastes and end-of-life vehicles, as suggested by the POP-PBDEs Inventory Guidance (see the POP-PBDEs Inventory Guidance, 2.1.2).

Step 1-3 (Develop the work plan for a national inventory): The overall work plan for NIP update was set as found below, while the output and activities for the inventory for POP-PBDEs were articulated in Output 2.2 of the work plan attached below (See the POP-PBDEs Inventory Guidance, 2.1.3).



The rough design of the POP-PBDEs inventory was also discussed by identifying resources, responsibilities, stakeholder involved and budgets assigned for each activity. The details are to be determined in the later steps of the inventory.

**Step 2: Stakeholder identification**

The following target sectors have been identified in the objective and scope setting in country A for establishing individual POP-PBDEs inventories (See the POP-PBDEs Inventory Guidance, 2.2):

* Electric and Electronic Equipment (EEE) and related wastes (WEEE);
* Transport;

Other sectors were not considered relevant for country A.

For a detailed stakeholder assessment of the sector within the country following steps were undertaken as described in the inventory guidance’s transport sector.

Appropriate members of the inventory task team should be selected to conduct the inventory of the transport sector. Further specific stakeholders for the inventory of the transport sector and end-of-life vehicles were identified as follows:

* Ministry of transport or other ministry responsible for transport sector;
* Ministry responsible for waste management;
* Association of importer and exporters of cars and other vehicles;
* Retailers of vehicles (in particular second hand vehicles);
* Association or main stakeholders of scrap recycling;
* Association and main stakeholder polymer recycling;
* University group(s) working material flows, waste management or on transport sector;
* NGOs working on transport and the sound management of hazardous waste and chemicals.

Major stakeholders initially identified were contacted by telephone, and a consultation meeting was held to explain the project outline to the major stakeholders. Those stakeholders were invited to in the inception workshop on NIP update and new POPs inventory that was organised in cooperation with the regional Stockholm Convention Focal Point.

**Step 3 (Methodology for Data Collection):** The evaluation of available and relevant national data on the transport sector was conducted and the following existing data were identified.

* Number of registered cars, busses and trucks (data from the Ministry of Transport) since 2000 (2000-2010) including the production year data;
* Number of imported vehicles in the past 5 years (2007-2010) including the production year data;
* Total numbers of cars, busses and trucks having reached their end of life stage (removed from the registration) since 2000 (2000 to 2010) including the production year data;
* Waste management practice of the end of life vehicles including characteristics (number, weight, type of vehicles) of vehicles treated by the major stakeholders;
* Recycling practice of the polymer materials resulting from the end-of-life treatment of cars including amounts of plastic from dashboard and bumpers and polyurethane foams from seats and head/arm rest etc handled by the major stakeholders.

After data compilation, a gap analysis was conducted to identify missing data (data before 2007) needed to fill out tables 5-1 to 5-4 in the inventory guidance. A survey was launched to generate the missing data.

The survey was conducted by a joint inventory team of a University and a research institution working on resources and waste management (task team member) in cooperation with the Ministry of Environment, the Ministry of Transport and a local consultant. Other task team members supported the study where they could get access to relevant data.

The survey conducted by face to face interviews with the association of importers and exporters of vehicles were able to collect data on imported cars between 2000 and 2007 but without production year data. However the rest of the missing data was not successfully identified, and the expert judgement needed to be engaged to estimate the following data to fill out Table 5-1 to 5-4.

* Expert survey for specific estimation:
	+ Number of registered cars, busses and trucks between 1975 and 1999;
	+ Number of cars, busses, and trucks imported between 1975 and 1999;
	+ Age distribution of imported vehicles between 2005 and 2007 (percentage of cars older then the 2005 cut off date);
	+ Number of cars, busses and trucks having reached their end of life stage (removed from the registration) between 1975 to 1999;
	+ Distribution of the originating regions of the imported vehicles;
	+ Presence and extent of polymer recycling sector in the country.

**Step 4: Data collection and compilation**

The country A (50 million inhabitants) has found that, 8 million passenger cars, 0.4 million busses and 0.12 million trucks were officially registered in the country. The Ministry of Transport estimated that most busses and trucks were registered officially, but that a further 2 million passenger cars currently in operation in country A were not registered and that therefore about 10 million cars were in use.

Based on the evaluation of all the data compiled, the following assessments have been made for the vehicle age distribution and estimation of originating regions of imported vehicles in this country.

A. Information on current transport fleet

* 10 million passenger cars, 0.4 million busses and 0.12 million trucks;
* Of the current transport fleet, 60% of passenger cars, 75% of busses and 75% of trucks were produced before 2005;
* Passenger cars and busses have mainly been imported from Asia (40%), and Europe (35%) and to some extent from North America (25%; largely from the US);
* Trucks were mainly from Europe (50%) and North America (50%).

B. Information on imports of the inventory year

* In 2010, 1 million cars, 40,000 busses and 20,000 trucks were imported;
* Only 20% of imported cars in 2010 were estimated to be produced before 2005;
* 40% of imported busses and trucks in 2010 were estimated to be older then 2005;
* Current imports of passenger cars have mainly been from Asia (50%), Europe (30%) and North America (20%);
* Busses have mainly been imported from Asia (60%) and Europe (40%);
* Trucks have been imported from Europe (50%) and from North America (50%) at comparable level.

C. End of Life vehicles and End of Life Treatment:

I) End of Life Vehicle in 2010

* + Approx. 800,000 cars, 30,000 busses and 20,000 trucks were removed from the vehicle registration;
	+ 95% of these vehicles were estimated to have been produced before 2005;
* Regional distribution of these vehicles were estimated as similar to the current vehicle fleet: Passenger cars and busses from Asia (40%), Europe (35%) North America (25%); Trucks mainly from Europe (50%) and North America (50).

II) Total End of Life between 1975 - 2010:

* + - * 15 million passenger cars, 0.5 million busses and 0.4 million trucks;

 99% of these vehicles have been produced before 2005;

Regional distribution of these vehicles were thought to be similar to the current car and bus fleet

 (Asia (40%), Europe (35%) North America (25%)); and trucks (Europe (50%) and North America (50); 80% have been subjected to some form of End of Life treatment (recovery of economically viable parts, e.g. iron, tyres, catalyst converters, copper from cables);

 • Iron, copper and catalysts have subsequently been exported;

 • No recycling has been reported for plastic and polyurethane foam from car and bus but has been deposited to landfills and dump sites;

 • 20% of these are stored in scrap yards and near the road side awaiting further waste management.

Amount of POP-POP-PBDESs in vehicle in current use of the inventory year 2010 (please note that only the vehicles produced between 1985 and 2004 are considered for the POP-PBDES inventory)

|  |  |  |
| --- | --- | --- |
| Number of cars/trucks (produced in US before 2005) | Amount of c-PentaBDE per car/truck | Total amount POP-POP-PBDESs in cars in use and formerly produced in US in 2010 |
| 21a) Cars: 10 million x 0.6 x 0.25 = 1,500,000Trucks: 0.12 million x 0.75 x 0.5 = 45,000 | 160 g/car | **No. of cars and trucks (1,545,000 ) x 0.16 kg x 0.5\*= 123,600 kg** |
| Number of cars/trucks in use (produced in non-US regions before 2005) | Amount of c-PentaBDE per car/truck | Total amount POP-POP-PBDESs in cars in use (formerly produced in regions other than US) in 2010 |
| 21b)Cars: 10 million x 0.6 x 0.75 = 4,500,000Trucks: 0.12 million x 0.75 x 0.5 = 45,000 million | 160 g/car | **No. of cars and trucks (4,545,000) x 0.16 kg x 0.05\*= 36,360 kg** |
| Number of busses in use (produced in US before 2005) | Amount of c-PentaBDE per bus | Total amount POP-POP-PBDESs in busses in use (formerly produced in US) in 2010 |
| 21c)0.4 million x 0.75 x 0.25 = 75,000 | 1000 g/bus | **No. of busses (75,000) x 1 kg x 0.5\*= 37,500 kg** |
| Number of busses in use (produced in other regions before 2005) | Amount of c-PentaBDE per bus | Total amount POP-POP-PBDESs in cars in use (formerly produced in regions other than US) in 2010 |
| 21d)0.4 million x 0.75 x 0.75 = 225,000 | 1000 g per bus | **No. of busses (225,000) x 1 kg x 0.05\*= 11,250 kg** |
| Total POP-POP-PBDESs 21) |  | **Sum of POP-POP-PBDESs: 208,710 Kg**  |

 \*factors derived from the estimated share of vehicles impacted with POP-POP-PBDESs from the US (50%) and non-US (5%) regions (vehicles produced from 1975 to 2004).

Amount of POP-POP-PBDESs in imported vehicles for the inventory year 2010 (please note that only the vehicles produces between 1975 and 2004 are considered for the POP-PBDES inventory)

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| --- | --- | --- |
| Number of imported cars/trucks (produced in US before 2005) | Amount of c-PentaBDE per car/truck | Total amount POP-PBDES in cars imported from US in 2010 |
| 22a)Cars: 1 million x 0.2 x 0.2 = 40,000Trucks: 20,000 x 0.4 x 0.5 = 4,000 | 160 g per car/truck | **No. of cars and trucks (44,000) x 0.16 kg x 0.5\*= 3,520 kg POP-POP-PBDESs** |
| Number of imported cars/trucks (produced in other regions before 2005) | Amount of PentaBDE per car/truck | Total amount POP-PBDES in cars imported in 2010from regions other than US |
| 22b)Cars: 1 million x 0.2 x 0.8 = 160,000Trucks: 20,000 x 0.4 x 0.5 = 4,000 | 160 g per car/truck | **No. of cars and trucks (164,000) x 0.16 kg x 0.05\*= 1,312 kg POP-POP-PBDESs** |
| Number of imported busses (produced in US before 2005) | Amount of PentaBDE per bus | Total amount POP-PBDES in imported busses in use (produced in US before 2005) in 2010 |
| 22c)40,000 x 0.4 x 0 = 0 | 1000 g per bus | **No. of busses (0) x 1 kg x 0.5\*= 0 kg POP-POP-PBDESs** |
| Number of busses (produced before 2005 in regions other then US) | Amount of PentaBDE per bus | Total amount POP-PBDES in imported busses in use in 2010 (produced before 2005 in regions other than US) |
| 22d)40,000 x 0.4 x 1 = 16,000 | 1000 g per bus | **No. of busses (16,000) x 1 kg x 0.05\*= 800 kg POP-POP-PBDESs** |
| **Total POP-POP-PBDESs 22)** |  | **Sum of POP-POP-PBDESs: 5,632 kg**  |

\*factors derived from the estimated share of vehicles impacted with POP-POP-PBDESs from the US (50%) and non-US (5%) regions (vehicles produced from 1975 to 2004).

Amount of POP-POP-PBDESs in end-of-life vehicles for the inventory year 2010 (please note that only the vehicles produced between 1975 and 2004 are considered for POP-PBDES inventory)

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| --- | --- | --- |
| Number of ELV cars/trucks (produced in US before 2005) | Amount of c-PentaBDE per ELV car/truck | Total amount POP-PBDES in ELV cars/trucks in 2010 (produced in US before 2005) |
| 23a)Cars: 800,000 x 0.95 x 0.25 = 190,000Trucks: 20,000 x 0.95 x 0.5 = 9,500 | 160 g per car/truck | **No. of cars and trucks (199,500) x 0.16 kg x 0.5\*= 15,960 kg POP-POP-PBDESs** |
| Number of ELV cars/trucks (produced in other regions before 2005) | Amount of c-PentaBDE per car/truck | Total amount POP-PBDES in ELV cars/trucks in 2010 (produced in other regions than US before 2005) |
| 23b)Cars: 800,000 x 0.95 x 0.75 = 570,000Trucks: 20,000 x 0.95 x 0.5 = 9,500 | 160 g per car/truck | **No. of cars and trucks (579,500) x 0.16 kg x 0.05\*= 4,636 kg POP-POP-PBDESs** |
| Number of ELV busses (produced in US before 2005) | Amount of c-PentaBDE per bus | Total amount POP-PBDES in ELV busses in 2010 (produced in US before 2005) |
| 23c)30,000 x 0.95 x 0.25 = 7,125 | 1000 g per bus | **No. of busses (7,125) x 1 kg x 0.5\*= 3,562 kg POP-POP-PBDESs** |
| Number of ELV busses (produced from other regions before 2005) | Amount of c-PentaBDE per bus | Total amount POP-PBDES in ELV busses in 2010 (produced in other regions than US before 2005) |
| 23d)30,000 x 0.95 x 0.75 = 21,375 | 1000 g per bus | **No. of busses (21,375) x 1 kg x 0.05\*= 1,068 kg POP-POP-PBDESs** |
| Total POP-POP-PBDESs 23) |  | **Sum of POP-POP-PBDESs: 25,226 kg**  |

\*factors derived from the estimated share of vehicles impacted with POP-POP-PBDESs from the US (50%) and non-US (5%) regions (vehicles produced from 1975 to 2004).

Amount of POP-POP-PBDESs in wastes from end-of-life vehicles disposed to landfills/dumps from 1980 until inventory year 2010 in the country (please note that only the vehicles produced between 1975 to 2004 are considered for POP-PBDES inventory)

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| --- | --- | --- |
| Number of cars/trucks (produced in US before 2005) where wastes have been disposed. | Amount of c-PentaBDE per car/truck | Total amount of POP-POP-PBDESs in disposed wastes from cars/truck (produced in US before 2005) from 1980 to inventory year 20XX  |
| 24a)Cars: 15 million x 0.99 x 0.25 = 3,712,500Trucks: 0.4 million x 0.99 x 0.5 = 198,000 | 160 g/car | **No. of cars and trucks (3,910,500) x 0.16 kg x 0.5\*= 312,840 kg POP-POP-PBDESs** |
| Number of cars/trucks (produced in other regions 2005) where wastes have been disposed. | Amount of c-PentaBDE per car/truck | Total amount of POP-POP-PBDESs in disposed wastes from cars/truck (produced in other regions than US before 2005) from 1980 to inventory year 20XX |
| 24b)Cars: 15 million x 0.99 x 0.75 = 11,137,500Trucks: 0.4 million x 0.99 x 0.5 = 198,000 | 160 g/car | **No. of cars and trucks (11,335,500) x 0.16 kg x 0.05\*= 90,684 kg POP-POP-PBDESs** |
| Number of busses (produced in US before 2004) | Amount of c-PentaBDE per bus | Total amount of POP-POP-PBDESs in disposed wastes from busses (produced in US before 2005) from 1980 to inventory year 20XX |
| 24c)0.5 million x 0.99 x 0.25 = 123,750 | 1000 g per bus | **No. of busses (123,750) x 1 kg x 0.5\*= 61,875 kg POP-POP-PBDESs** |
| Number of busses (produced from other regions before 2005) | Amount of c-PentaBDE per bus | Total amount of POP-POP-PBDESs in disposed wastes from cars/truck (produced in other regions than US before 2005) from 1980 to inventory year 20XX |
| 24d)0.5 million x 0.99 x 0.75 = 371,250 | 1000 g per bus | **No. of busses (371,250) x 1 kg x 0.05\*= 18,562 kg POP-POP-PBDESs** |
| **Total POP-POP-PBDESs 24)** |  | **Sum of POP-POP-PBDESs: 483,961 kg**  |

\*factors derived from the estimated share of vehicles impacted with POP-POP-PBDESs from the US (50%) and non-US (5%) regions (vehicles produced from 1975 to 2004).

Calculation of POP-POP-PBDESs present in the transport sector (date from table 21 to table 24) to the POP-POP-PBDES homologues (TetraBDE, PentaBDE, HexaBDe and HeptaBDE) for the relevant life cycle stages

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Distribution homologues c-PentaBDE | POP-POP-PBDES in vehicles currently in use in inventory year 2010(in kg) | POP-POP-PBDES imported[[1]](#footnote-1) in vehicles in the inventory year 2010(in kg) | POP-POP-PBDES in end-of-life vehicles in the inventory year 2010(in kg) | POP-POP-PBDES disposed off in the past from the transport sector(in kg) |
| Inventoried c-PentaBDE |  |  Σ POP-POP-PBDESs 21)208,710(2.1 x 105) |  Σ POP-POP-PBDESs 22)5,632(5.6 x 103) |  Σ POP-POP-PBDESs 23)25,226(2.5 x 104) |  Σ POP-POP-PBDESs 24)483,961(4.8 x 105) |
| TetraBDE | 32% | 66,787 (6.7 x 104) | 1,802(1.8 x 103) | 8,072(8.1 x 103) | 154,867(1.5 x 105) |
| PentaBDE | 56% | 116,877(1.2 x 105) | 3,153(3.1 x 103) | 14,126(1.4 x 104) | 271,018(2.7 x 105) |
| HexaBDE | 9% | 18,783(1.9 x 104) | 506.88(5.1 x 102) | 2,270(2.3 x 103) | 43,556(4.3 x 104) |
| HeptaBDE | 0.5% | 1,043(1.0 x 103) | 28.16(2.8 x 10) | 126.1(1.3 x 102) | 2,419.8* 1. x 103)
 |

1. Please note that the imported vehicles are also included in the inventory of “currently in use/sale” and that these two categories are not summed up. [↑](#footnote-ref-1)