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## PROBLEM OF SOLID WASTE IN SRI LANKA AND EXISTING MANAGEMENT STRATEGIES

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### ABSTRACT

*As a developing country, in Sri Lanka, Solid Waste (SW) has become one of the growing national problems, especially in urban areas. Yet, the main issue is there is no proper mechanism either at national or local level in managing the SW problem. However, at present the Central Government gives priority to address this issue and responsible authorities initiate and implement several strategies to manage the SW problem. This paper will discuss the current situation of SW problem and management strategies from sociological point of view.*

**KEY WORDS:** *Solid Waste, Solid Waste management, Local Authorities*

### 1. INTRODUCTION

Solid waste has become a critical global issue with the increasing population, urbanization, consumerism and expansion of new technologies especially in urban setup. In Sri Lanka after introduction of open economy in 1977, the processes of industrialization and urbanization intensified. As a result SW generation also has increased day by day. Especially, in Sri Lanka Municipal Solid Waste (MSW) is a pressing problem that has become more severe over the last ten years (Karunasena & Wickramasundara, 2012). Therefore SW can be seen as a multidimensional threat to Sri Lankan environment (Wijeratne et al, 2012). As a solution to

this problem sustainable Solid Waste Management (SWM) strategies and use of integrated SWM concepts are becoming important. For them community participation is decisive (Bernstein, 2004) since, community is the main generator of household SW and that amount has increased in the previous decade (Bandara et al, 2007). Within this context, this paper seeks to examine the current situation of SWM in Sri Lanka discussing SW problem in Sri Lanka in relation to historical development of SW problem in the country, waste generation and composition, socio-economical and cultural influences for SW generation and problems arising with the increasing SW. Also the paper discusses SWM in Sri Lankan

context with regards to institutional and legislative initiatives in managing SW and present situation of SWM strategies

## **2. SOLID WASTE PROBLEM IN SRI LANKA**

### **2.1. History of Solid Waste problem**

The relationship between man and environment on the earth has varied from the early periods of human settlement to the present day. This variation has occurred due to human culture, which is their living pattern. Sri Lanka, as an agricultural society was inspired by Buddhism and an environmental value system that evolved with the nature-based ideology (Herath, 2009). These people utilized unlimited natural environment to promote their welfare in an environmental friendly manner being as part of nature. Their day to day necessities were limited and simple in nature in every stage of their lives. Shelter was prepared using hay, clay or wood. Tools and related technologies did not cause any damage to natural existence. Food pattern was completely built on nature base. Therefore, a very small amount of things were discarded to environment after their usage. All of them were degradable material which did not make any harm to the natural surrounding.

Further in the agrarian society, livelihood was a fragment of nature since, their cultivation methods and modes were adopted so as to consume natural ingredients like, cow dung, plant braches and hay. Life style was not complex and mostly tied with environmental values created by Buddhist culture. As a result of that discarding things was not harmful to environment more specifically, SW.

However, until Sri Lanka opened to global socio economic process in 1977, SW was not a considerable problem. This situation was accelerated by industrialization and urbanization processes in the country. Parallel to these processes urban population in Sri Lanka has increased. As World Bank reveals, in 1990 it was 2,943,527.5, in 2000 it was 2,999,014 and in 2010 it was 3,118,603. Out of the total population of the country 15.1 % were urban in 2010. It was 15.7 % in 2000 and 17.2 % in 1990 (Trading

economics, 2015). When the urban population increased, there were some other changes that happened which contributed to generate unmanageable quantities of SW. In one aspect commercial establishments increased parallel to the emergence of small plot sizes with regard to urban population. On the other hand these urban populations adopted modern life styles and food habits which caused to the generation of SW (SATREPS, 2014a).

### **2.2 Generation of Solid Waste in Sri Lanka**

The generation amount of SW is increasing day by day especially, MSW. It has increased with the rapid changes of consumption patterns in the country (Bandara *et al.*, 2007). Total waste generation in Sri Lanka is around 6,400 tons per day (Madhushan *et al.*, 2011; Wijetunga, 2012). According to statistics of National Solid Waste Management Support Centre (NSWMS), 10, 497 tons of waste generated per day in the year 2014. Out of all provinces, western province is the most waste generated province which represents 60% of total waste generation amount of the country. It is 3000-3500 Mt per day and it has predicted to increase to 5274 Mt per day in 2050. In every year waste generation rate increases by 1.2% (Mannapperuma, 2015). Data has revealed that the amount of MSW per capita per day was 0.85 kg in Colombo Municipal Council (MC), 0.75 kg in other MCs, 0.60 kg in Urban Councils (UC) and 0.40 kg in Pradesheeya Sabas (PS) (National Policy on Solid Waste Management, 2007; Liyanage *et al.*, 2015). With this regard, Sri Lankan LAs face great difficulties with the collection and removal of a huge amount of waste.

There is a lack of updated data on waste collection amounts at provincial level in the country. However, table 1 shows MSW data collection by LAs in the year 2005.

**Table 1: Municipal Solid Waste Data Collection by the Local Authority**

Province	District	Gross weight of waste collected per day (Ton)	District percentage	Provincial total	Provincial percentage all Island
Western	Colombo	1,257	44.3%	1,663	58.6%
	Gampaha	313	11.0%		
	Kaluthara	93	3.3%		
Southern	Galle	103	3.6%	198	7.0%
	Mathara	68	2.4%		
	Hambanthota	28	1.0%		
Central	Kandy	145	5.1%	229	8.1%
	Matale	33	1.2%		
	Nuwaraeliya	51	1.8%		
Northwestern	Kurunagala	73	2.6%	170	6.0%
	Puttalam	97	3.4%		
Sabaragamuwa	Rathnapura	49	1.7%	92	3.2%
	Kegalle	43	1.5%		
Uva	Badulla	57	2.0%	86	3.0%
	Monaragala	28	1.0%		
North Central	Anuraddhapura	52	1.8%	74	2.6%
	Polonnaruwa	22	0.8%		
Eastern	Ampara	57	2.0%	233	8.2%
	Batticaloa	119	4.2%		
	Trincomalee	56	2.0%		
Northern	Jaffna	71	2.5%	93	3.3%
	Mannar	4	0.1%		
	Kilinochchi	1	0.0%		
	Mullaitiev	9	0.3%		
	Vavuniya	9	0.3%		
<b>Total</b>		<b>2,838</b>	<b>100.0%</b>	<b>2,838</b>	<b>100.0%</b>

(Source: Ministry of Environmental and Natural Resources (2005) Database of Municipal Solid Waste in Sri Lanka. Ministry of Environmental and Natural Resources: Battaramulla)

As the above table (table 1) illustrates western province is the most waste collected province in the country. Even it is true for today as well that it

collects 2,100 Mt per day which represents 60% from the total waste collection of the country (Mannapperuma, 2015). This has happened due to

high population congestion, industrial and commercial activities centered around the western province. The second most waste collected province is the central province. There is a clear gap between the most waste collected western province and second most waste collected central province related the amounts of waste collection. Sequentially it is 1,663 tons and 229 tons. However, Sri Lanka LAs collect 2,838 tons of waste according to table 1. According to National Policy on Solid Waste Management (2007) it is about 2,700 tons. Anyhow NSWMS data reveals among this total amount of waste generation in the year 2014, 3,552 tons of waste collected per day. However, approximately, 40% of MSW generated in Sri Lanka is being collected (Pilapitiya, 2012). Similarly, there are socio-economic and cultural factorial influences on this waste generation.

### **2.3 Influence of socio-economic and cultural factors on Solid Waste generation**

Solid waste generation rate increases not only due to increment of urban population, but also due to their socio-economic and cultural factors which have an influence on it. Especially living standards (Wertz, 1976; Grossman *et al.*, 1974) number of members in a household unit, cultural patterns and level of education and attitudes also make an effect on the amount of generation of SW (Al-Momani 1994; Grossmann *et al.*, 1974).

High income families generate more kitchen waste than other income levels (SATREPS, 2014b; Wijerathne *et al.*, 2012; Bandara *et al.*, 2007). Similarly, non-degradable fraction of the waste is high among them (SATREPS, 2014b; Wijerathne *et al.*, 2012). Their food consumption rate is relatively high and has increased the purchases of packaged products (Bandara *et al.*, 2007). That leads to change their food pattern that is mostly directed towards artificial packaged items which causes to increase the plastic, polythene and glass composition of the generated waste. At the same time it shows a high propensity to prepare meals at homes (ibid). Moreover, in the high income group, when the number of individual employees in a household unit increase, it also causes to generate a larger amount of organic waste (ibid). This has happened due to high level of consumerism among them.

Similarly, when the number of members in a household unit increases, it causes to reduce the per capita waste generation rate (ibid). Similarly, environmental attitude of Sinhalese is higher than that of Muslims (Mahees and Silva, 2011) as Muslims are more business oriented. Also there are variations which occur related to waste generation, due to consuming patterns of cultural festivals.

These factors significantly influence the SW generation rate in the country. Waste composition also varies with the huge generation amount.

### **2.4. Composition of solid Waste in Sri Lanka**

Waste composition of the country generally tends to be categorized as biodegradables and non-biodegradables. They include metals, wood, glass, paper, building and demolition waste, slaughter house waste. The other waste comprises saw dust/paddy husk and garment waste. From these two categories, 65%-66% belong to degradable waste (Bandara, 2011). For example 79% of collected waste in KMC, 83% in Gampola UC, 82% in Udapalatha PS, 80% in Galle MC and 87% in Hambanthota MC are degradable waste (SATREPS, 2014a). Similarly it has been revealed that, 40,000 tons of recyclable hazardous waste is generated per year in Sri Lanka (Hathiramani, 2010). Furthermore, 61 tons of health care waste is generated from hospitals in Sri Lanka (Wijayapala, 2012). All the above data show the severity of SW problem in Sri Lanka.

### **2.5 Problems arise with Solid Waste**

Solid waste brings forward negative impacts (Perera, 2003) on the well balanced environment and hence to society in every sphere. Unacceptable disposal of SW is one of the prime environmental issues faced by the country at present (Bandara, 2011). Especially, uncontrolled, illegal and open dumping are directly contributing to environmental pollution; underground water contamination, land degradation and contamination, air pollution, particularly releases of Green House Gases and toxic substances. Also it causes to create problems and damages to drainage systems, streams, rivers, lagoons, reservoirs and tanks. Health problems (diarrhea, spread of vector borne diseases such as, dengue and filarial and respiratory illness) problems to flora and fauna and natural habitat, loss of property values in nearby areas to disposal sites and social discrimination to nearby residents is another critical social issue. These problems tend to look for a system of SWM.

## **3. SOLID WASTE MANAGEMENT IN SRI LANKA**

There are several strategies for managing SW in Sri Lanka as it becomes a national problem. Yet it was not problematic in past due to existed socio, cultural, demographical and environmental conditions. However, at that time also people practiced strategies to use SW as a resource.

### **3.1 History of Solid Waste Management**

Solid waste management is a process of managing SW from generation to final disposal. In early days, people used tradition SWM strategies, especially,

traditional composting methods like ‘*Wala kramaya*’ and ‘*Goda kramaya*’. Although these were not systematic waste management strategies, these caused to reduce the discharge amount of waste to environment. Later on people acquired the service of ‘*Bothal Paththara Karaya*’ in so far as waste was not a problem to them. However, these methods were not enough to manage SW problem due to huge amount of waste generation in present time.

### 3.2 Present Situation of Solid Waste Management Strategies

Strategies used in SWM cover waste generation to final disposal. In this process waste collection is one of the important things in the total SWM process. It is provided largely by the public sector in Sri Lanka with a few exceptions of private sector service provisions. Public sector collection service is characterized by irregular service provisions. Public sector collection service is characterized by irregular service times and poor levels of service. Most LAs, particularly UCs and PS have a low collection service coverage, generally in the range of 65% and 50% respectively. This is quite significant considering that 72% of the population lives in semi-urban and rural areas. The MC collection service coverage is better-reaching up to 80% in a few urban areas, however disposal poses a much more significant problem in densely populated urban areas (Pilapitiya, 2012).

Community based source separation, re-use, composting, recycling schemes, initiated by variety of stakeholders such as, NGOs, LAs, and community groups have been implemented amongst low, middle and high income households in certain urban LAs.

Waste separation and re-use methods are introduced to the country strengthening the public awareness using the committees. There is significant potential for composting and there are insignificant commercial returns from such endeavors. Several small to medium scale composting plants for MSW have been constructed and are in operation at present. JICA reports that most composting operations have failed due to LAs not paying adequate attention to operation and maintenance costs as well as embarking on the venture with a belief that all waste treatment costs can be recovered from the sale of compost.

In the year 2007, Central Environment Authority implemented and initiated two projects namely, National Post Consumer Plastic Waste Management Project and ‘*Pilisaru*’ project. The main aim of the projects was to solve SW problem in achieving following objectives (MuthukudaArachchi, 2016).

1. Preparation of a national policy on SWM.
2. Preparation of strategies for the SWM.
3. Provision of training on effective SWM including education and awareness for relevant officers.
4. Provision of necessary facilities for implementation of SWM projects and programs.
5. Strengthening the legal framework for SWM.

The ‘*Pilisaru*’ project was initiated in 2008 to reutilize the disposed waste to the maximum extent possible and to dispose the non-utilizable residue. There are certain numbers of ongoing composting projects which are carried out under ‘*Pilisaru*’ as seen in table 2.

**Table 2: Ongoing Compost Projects Funded by *Pilisaru* Project**

Waste Quality per day	Number of Operational Compost Project
Less than 5MT	89
6 – 10 MT	17
11 – 20 MT	4
21 – 30 MT	2
31 – 40 MT	3
41 – 50 MT	1
More than 50 MT	None

Source: MuthukudaArachchi, K.H, 2016, *Environmental Regulations, Guest Speech, South Asian Symposium for Environmental Sciences, March 17<sup>th</sup> -18<sup>th</sup> 2016, University of Peradeniya.*

As seen in table 2 currently 116 operational compost projects are ongoing under the funding of *Pilisaru*. Further, several recycling centers are also established in the country. *Colombo, Kurunagala, Kandy, Maharagama*, areas are examples of those. In addition to recycling centers, recycling item collecting centres are also established in major cities of the country.

Other than this *Pilisaru* project on composting, *Takakura* style composting has been promoting since 2014. This was invented by Mr. *Takakura* of JPEC Co., Ltd in Japan. This compost uses microorganisms to fasten the decomposition process of organic waste. Also it reduces bad order generated in the decomposition process using low cost locally available materials. Recently Japanese Overseas Cooperation Volunteers (JOCV) were sent

off to implement this knowledge among citizens. The training on this composting style is shared among 30 municipalities in Sri Lanka (SATREPS, 2016)

Although incineration of MSW is spoken of as an option for waste treatment by political leaders in Sri Lanka, the waste composition, moisture contents and calorific value of the waste is not conducive for incineration. Characteristics of waste in Sri Lanka is very similar to MSW in other South Asian countries and this fact that there are no commercially operating incinerators for MSW in any South Asian country is evidence that this technology is not a viable option for waste treatment in Sri Lanka in immediate future (Pilapitiya, 2012). Related to incineration, production of bio char is also another option. For example, in Kandy.

The preferred option of final disposal, at present is effectively wild dumping or open dumping which is a major problem in Sri Lanka. Lack of appropriate lands for waste disposal has aggravated this problem. More than 95% of waste are disposed to open dumps in the country with no regard for adverse environmental and public health impacts. (ibid). *Meethotamulla* and *Gohagoda* open dump sites are examples for that. The characteristics of such disposal sites are that these sites are small, generally 1-2 ha in area, with short life spans. As a solution, sanitary landfills have been established. For example *Mawanella* and *Nuwaraeliya (Sadhatanne)* sanitary landfill. Table 3 shows sanitary landfills which are in operational stage.

**Table 3: Sanitary Landfills in Operation**

Location	Funding Agency	Capacity	Status
Dompe (Western Province)	KOICA	90 MT/d	Operational Stage
Batticaloa (Eastern Province)	ADB	99 m <sup>3</sup> /d	Operational Stage
Ampara District (Eastern Province)	Eu/UNOPS	100 m <sup>3</sup> /d	Operational Stage

Source: MuthukudaArachchi, K.H, 2016, *Environmental Regulations, Guest Speech, South Asian Symposium for Environmental Sciences, March 17<sup>th</sup> -18<sup>th</sup> 2016, University of Peradeniya.*

In addition, cluster landfill sites are also proposed as the recent option. Cluster landfills are landfills which are shared by several LAs. Under the Environmental Remediation Program (ERP) from the EU funds and the United Nations (UNOPS), 7 engineered landfills, 5 compost sites, 1 waste transfer facility and 4 recycle facilities were constructed. The first and largest one is situated in *Ampara* which is a wide-area disposal site of sanitary landfill used by several LAs (see table 5). The administrative system

of this wide-area SWM site consists an Advisory Committee representing relevant LAs. A meeting is held every three months. Similarly Environment Police formed for the safeguard of law enforcement. Each LA has established a section to compile a database of waste flow. There are also attempts to close illegal dump sites. There are cluster type of landfills including a compost yard are proposed to be established in Sri Lanka as seen in table 4.

**Table 4: Proposed Cluster Landfills in Sri Lanka**

Location	Funding Agency	Present Status
Puttalam (Aruwakkalu) Transfer Meethotamulla waste to North Western Province	Sri Lanka Government Treasure fond	EIA stage and possible change of the proposed location
Anuradhapura (Keerikkulama)	EDCF Exim Bank / Korea	Detailed design stage
Polonnaruwa (Medirigiriya)	EDCF Exim Bank / Korea	Detailed design stage
Hikkaduwa (Galle)	EDCF Exim Bank / Korea	Detailed design stage
Jaffna (Keeramale)	EDCF Exim Bank / Korea	Detailed design stage

Source: MuthukudaArachchi, K.H, 2016, *Environmental Regulations, Guest Speech, South Asian Symposium for Environmental Sciences, March 17<sup>th</sup> -18<sup>th</sup> 2016, University of Peradeniya.*

As seen in table 4, there are five cluster landfills proposed under Korean and Sri Lankan governmental funding.

Power or energy generation from solid waste is another strategy that has been adopted in SWM process. *Karadiyana and Kerawalapitiya* are proposed

sites for waste to energy projects in Sri Lanka. Similarly several projects are under construction for producing Bio Gas from waste.

**Table 5: Waste to Energy projects under construction**

Location	Waste Quantity	Nature	Generation Capacity
Matara MC	30 MT/d	Bio Gas	8 MW
Kaduwela MC	60 MT/day	Bio Gas	15 MW

Source: MuthukudaArachchi, K.H, 2016, *Environmental Regulations, Guest Speech, South Asian Symposium for Environmental Sciences, March 17<sup>th</sup> -18<sup>th</sup> 2016, University of Peradeniya.*

As shown in table 5 two Bio Gas producing projects are under construction in *Matara* and *Kaduwela* MC areas in Sri Lanka. However, LAs are facing difficulties when executing these programs.

Another strategy, Waste Management Zonal Concept, which was identified by Waste Management Authority, conducts public awareness programmes, such as, *PivithuruAyatana, ParisaraMithuro, PivithuruSuwaPiyasa, ParisaraKekuluandPivithuruAyatana* (Karunasena and Amarathunga, 2010; Dissanayake, 2013). Furthermore setting up a separate independent, SWM division in LAs is a revolutionary strategy in SWM sector. Solid waste management is most often a part of the health division in the LAs. Yet establishing a separate division with separate budgetary and management allocations is important for improvements of SWM as a whole. For example in KMC area this separation has caused to introduce new programs (waste separation, raise awareness, promoting composting) (SATREPS, 2016). This practical situation conceptually named as ‘Seven Steps of Waste Management’ is a SSWM (Sustainable Solid Waste Management) strategy identified by Sri Lanka Waste Management Authority to streamline the present disorganized waste management activities of LAs (Mannaperuma and Basnayake, 2007). Under this concept all activities related to waste management have been categorized into seven steps. Waste separation is the first in seven steps. Waste can be separate mainly into two categories, organic and inorganic and inorganic waste can be separated into another few categories, paper and cardboard, polythene and plastic, glass, tin, metal etc. The second step is door to door waste collection. This step is the most appropriate step that has to be taken in order to keep

clean environment. Cleaning of roads, drains and public places by MCs is the third step. Avoiding of open waste dumping places in the urban areas is the fourth step. The fifth step is systematic waste transportation following a timetable and appropriate equipment. Waste can be utilized as a resource by engaging activities like, recycling and composting is the sixth step. The final step of waste management is safe disposal of waste. These seven steps are important strategies that have been followed for a systematic waste management process.

Similarly establishing a training centre for SWM is considered as a valuable strategy in order to assist SW problem. *Balangoda* UC currently conducts a three months course on ‘Solid waste management Assistant Course’ with the support of the Provincial government, National Vocational Authority and Learn Asia Organization. *Balangoda* UC staff members, staff members from other LAs and students are permitted to join the training course and certificates are awarded after completion of the course (ibid).

Although these strategies are being executed, Sri Lankan LAs face key constraints in the SWM process.

### 3.3. Institutional and Legislative initiatives in managing Solid Waste

Sri Lankan government has identified, SWM as one of the medium term development goals in the country. Therefore it has given prior place for systematic management of SW using appropriate strategies. The main legal framework of waste management at national level is the National Environmental Act (No.47 of 1980) as amended in 1988, 2000. It provides the necessary legislative framework for overall SWM. According to provisions of the Local Government Act, the LAs in



Sri Lanka are responsible for collecting and disposal of waste generated by the people within their territories. Sri Lanka has 335 LAs which represent 21 MCs, 43 UCs and 271 PS (MuthukudaArachchi, 2016). Policies, strategies and legal provisions are in place to provide necessary actions for effective and sustainable involvements to SWM in the country.

The National Environmental Act, National Strategy for Solid Waste Management, National Agenda for Sustainable Development and a number of rules and regulations, directives have provided SWM related provisions covering different aspects (NSWMS, 2007). For example, provisions are given under the sections 129, 130 and 131 of the Municipal Council Ordinance; the sections 118, 119 and 120 of Urban Council (UC) Ordinance; and sections 93 and 94 of the Pradesheeya Saba (PS) Act (MuthukudaArachchi, 2016).

In 1981 Central Environment Authority was established which plays a major regulatory role in relation to environmental management at national level. Several projects, institutions and studies namely, Colombo Environment improvement Project and Capacity Development Project in 1995, commercial scale composting facility by Burns Environmental and Technologies Private Limited in 1995, studies initiated under JICA funding in 2002 are important landmark initiatives in SWM in Sri Lanka (SATREPS, 2013).

National Strategy of SWM in Sri Lanka was identified in the year 2002 (Bandara, 2011). National SWM strategies addressed the SWM process from waste generation to final disposal using sustainable strategies. Later, Solid waste Management Authority of Western Province was established under the Waste Management Statute No: 9 of 1999 of western provincial council in 2004 with the aim of keeping the province clean for the well-being of the people as well as for the flora and fauna. In 2007 National policy on SWM and NSWMS were created. The overall goal of the National Policy on SWM is to ensure integrated, economically feasible and environmentally sound SWM practices for the country. National Solid Waste Management Support Centre acts as a facilitator for providing technical and financial support for SWM.

In the past open dumping method was used to dispose waste and it was not a serious problem at the time due to free availability of degraded land. Nonetheless, currently LAs are facing land scarcity problem in disposing SW generated in their boundaries. Therefore the new technologies are being developed and are popular with regards to waste disposal sites and its management. Project for "Development of Pollution Control and Environmental Restoration Technologies of Waste Landfill Sites taking into Geographical

Characteristics" support with grant funds under Science and Technology Research Partnership for Sustainable Development (SATREPS) scheme of Japanese International Cooperation Agency (JICA) is one of the largest projects in Sri Lanka collaborating with many national and international partner organizations. The project is expected to develop a suitable guide for construction and management of SW landfills in Sri Lanka dealing with MSW and environmental protection which would bring decisive inputs for managing SW. This Guide will provide recommendations to manage landfill sites with appropriate technologies from landfill site selection to its maintenance and management.

Time to time with some changes, different initiatives have been taken in order to manage SW problem in the country. Yet, the waste generation rate has gone beyond the capabilities of SWM strategies.

#### 4. CONCLUSION

Solid Waste was became an issue in late 1970s in Sri Lanka due to the mass of scale socio-economical transformation that happened in the country. As a result SW generation has increased rapidly creating numerous problems in every aspect of the society. Time to time the government adopted institutional and legislative initiatives to manage this situation and currently new strategies are being implemented in order to cope with the existing state of the SW problem. Nevertheless existing SWM strategies are still behind in managing the problem comparing to the generation rate of SW in the country.

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