# PSA Selection System Documentation

## Executive Overview

The PSA (Public Service Announcement) selection system is a sophisticated content scheduling mechanism that **combines deterministic scoring with minimal randomization** to ensure fair, diverse, and contextually appropriate PSA placement throughout broadcast schedules. Contrary to common perception, PSAs are **not selected randomly** but through a carefully designed algorithm that balances multiple factors to achieve optimal distribution.

### Key Principles

- **Deterministic Selection**: PSAs are chosen based on calculated scores, not random chance
- **Smart Distribution**: Ensures PSAs don't cluster or repeat themes
- **Fairness Through Rotation**: All PSAs get airtime through systematic rotation
- **Context Awareness**: Considers surrounding content to avoid theme conflicts

## PSA Classification

### Content Type Definition

PSAs are identified by the content type code `PSA` in the database. They typically fall into the **"spots"** duration category (30-120 seconds), though some may be classified as **"id"** (5-30 seconds) for very brief announcements.

### Common PSA Themes

- Public Safety (gun safety, emergency preparedness)
- Health Awareness (vaccination, medical screenings)
- Community Services (housing assistance, job programs)
- Environmental Messages (recycling, conservation)
- Civic Engagement (voting, census participation)

## Selection Algorithm

### 1. Base Score Calculation

Every PSA starts with a base score of **100 points** plus a small random variation (-5 to +5 points) to break ties between otherwise identical content.

```
score = 100 + random.uniform(-5, 5)  # Base score with minimal randomization
```

### 2. Scoring Factors

#### Freshness Component (Implicit)

- Newer PSAs receive priority through lower play counts
- Recently encoded content appears higher in initial queries

**Play History Penalties** PSAs that have aired recently receive progressive penalties: - **Within 1 hour**: -100 points (heavy penalty) - **1-2 hours**: -50 points (medium penalty) - **2-4 hours**: -25 points (light penalty) - **4-6 hours**: -10 points (very light penalty) - **3+ plays in schedule**: -50 points × (plays - 2)

**Content Type Specific Rules** PSAs have a **2-hour minimum replay delay** by default, which is shorter than most content types, allowing them to rotate more frequently throughout the day.

**Theme Conflict Prevention** PSAs in the "spots" category are subject to strict theme checking: - **Same theme back-to-back**: -200 points (heavy penalty) - Prevents viewer fatigue from repetitive messaging - Ensures diverse public service messages

**Featured Content Boost** PSAs can be marked as "featured" for time-sensitive campaigns: - **Featured boost**: +150 points - Used for urgent public safety messages - Emergency announcements get priority placement

### 3. Selection Process

1. **Query Available PSAs**: System retrieves PSAs that:
    - Haven't exceeded replay delays
    - Aren't expired
    - Match the requested duration category
    - Haven't been explicitly excluded
2. **Calculate Scores**: Each candidate PSA receives a score based on:
    - Base score (100 ± 5)
    - Play history penalties
    - Theme conflict penalties
    - Featured status bonuses
3. **Select Best Candidate**: The PSA with the highest score is selected
    - Ties broken by the small random component
    - If all scores are negative, first available is used
4. **Update Tracking**: Selected PSA is recorded to prevent immediate replay

## Randomization Elements

### Minimal Random Components

1. **Tie Breaking**: ±5 points added to base score
    - Prevents identical content from always appearing in same order
    - Ensures variety when multiple PSAs have similar scores
2. **Query Ordering**: SQL queries include `ORDER BY RANDOM()` as final sort
    - Only affects items with identical priority
    - Provides variety in candidate pool
3. **No Pure Random Selection**: System never randomly picks from available PSAs
    - Every selection based on calculated scores
    - Randomness only provides minor variations

## Diversity Mechanisms

### 1. Rotation Through Inventory

- All PSAs get airtime through score-based rotation
- Recently played content penalized, giving others opportunity
- Natural cycling through entire PSA library

### 2. Theme Distribution

- Strict theme conflict prevention for spots category
- Ensures variety of public service messages
- Prevents clustering of similar topics

### 3. Time-Based Distribution

- 2-hour minimum spacing between same PSA
- Shorter delay allows more frequent rotation than other content
- Ensures important messages reach different audiences

### 4. Category Mixing

- PSAs scheduled as part of “spots” rotation
- Mixed with other short-form content
- Prevents PSA clustering

## Special Handling

### 1. Emergency PSAs

- Can be marked as “featured” for immediate priority
- Bypass normal rotation for urgent messages
- Still subject to minimum replay delays

### 2. Campaign PSAs

- Time-sensitive campaigns use expiration dates
- Automatically removed from rotation when expired
- Featured status for launch periods

### 3. Themed Periods

- Special handling during awareness months
- Increased priority for relevant PSAs
- Manual featuring of campaign content

## Configuration Parameters

### Default PSA Settings

```
{
  "content_type_delays": {
    "psa": 2  // 2-hour minimum between plays
  },
  "scoring_weights": {
    "base_score": 100,
    "featured_boost": 150,
    "theme_conflict_penalty": 200,
    "recent_play_penalty": 100
  }
}
```

### Tunable Parameters

- **Replay Delay**: Minimum hours between same PSA (default: 2)
- **Featured Boost**: Score bonus for featured PSAs (default: 150)
- **Theme Penalties**: Penalty for theme conflicts (default: 200)

## Common Misconceptions

### "PSAs are selected randomly"

**Reality**: PSAs are selected through deterministic scoring with only minimal randomization for tie-breaking. The selection process is highly predictable and based on objective criteria.

### "Some PSAs never get played"

**Reality**: The scoring system ensures all active PSAs eventually play through natural rotation as others accumulate penalties from recent plays.

### "PSAs cluster together"

**Reality**: Theme conflict prevention and category rotation specifically prevent PSA clustering, ensuring they're distributed throughout the schedule.

### "Important PSAs can't be prioritized"

**Reality**: The featured content system allows urgent or important PSAs to receive significant scoring boosts while still maintaining fair rotation.

## Best Practices

### 1. Content Preparation

- Assign clear themes to enable conflict prevention

- Set appropriate expiration dates for campaigns
- Use descriptive titles for better tracking

**2. Campaign Management**

- Mark time-sensitive PSAs as featured
- Set expiration dates to auto-remove outdated content
- Monitor play counts to ensure distribution

**3. Inventory Balance**

- Maintain diverse PSA library (15+ active PSAs)
- Regular content refresh to prevent staleness
- Balance themes across inventory

**4. Performance Optimization**

- Monitor replay delays to ensure adequate rotation
- Adjust featuring based on campaign needs
- Review theme conflicts in reports

## Monitoring and Reporting

### Available Metrics

- PSA play frequency by content
- Theme distribution analysis
- Replay delay compliance
- Featured content performance

### Key Performance Indicators

- **Unique PSA Ratio**: Variety of PSAs played daily
- **Theme Diversity Score**: Distribution of different themes
- **Replay Compliance**: Adherence to minimum delays
- **Coverage Metrics**: Reach across different dayparts

## Technical Implementation

### Database Structure

PSAs are stored in the `assets` table with: - `content_type = 'PSA'` - `duration_category` (usually 'spots') - Theme information in metadata - Featured flags in `scheduling_metadata`

### Selection Query

The system uses sophisticated SQL queries that: - Filter by availability and expiration - Calculate play history - Order by multiple factors - Include slight randomization

### Score Calculation

Implemented in Python with: - Clear scoring logic - Extensive logging for debugging - Configurable parameters - Performance optimization

## Conclusion

The PSA selection system represents a careful balance between predictability and variety. While not truly random, it achieves the appearance of randomness through intelligent rotation and scoring that ensures:

1. **Fair Distribution**: All PSAs receive airtime
2. **Contextual Appropriateness**: Theme conflicts avoided
3. **Campaign Effectiveness**: Priority content gets visibility
4. **Viewer Experience**: Diverse messaging without repetition

The system's sophistication ensures that public service messages reach their intended audiences effectively while maintaining the quality and variety expected in professional broadcast operations.